

IMPORTANT INFORMATION



When working on the engine. e.g. adjusting drive belts, changing oil or adjusting the clutch, it is important not to start the engine. There is a risk of damaging the engine but, more importantly, there is a

SERIOUS DANGER OF INJURY

For this reason, always secure the starter device or detach a battery lead before working on the engine.

This is especially important if the engine has a remote starter or automatic start.

This warning symbol and text is reproduced beside those maintenance points where it is especially important to consider the risk of injury.

START-UP REPORT- WARRANTY

When the start-up report has been filled in and sent to Scania, you have a 1 year warranty from the date of start-up. Also fill in the information below as this can make things easier if you need to contact a service workshop or the like.

Engine number

.....

Start-up date

.....

User's name and address

.....

.....

.....

Engine type

.....

Variant

.....

Engine type and variant are indicated on the engine type plate

Operator's Manual

DI14 69 (750 hp)

DI14 82 (800 hp)

Marine engine

opm96-750 en

1 588 538

2001-05:1



SCANIA

Industrial & Marine Engines

FOREWORD

This instruction manual describes the operation and maintenance of Scania marine engine DI14 69 (750 hp) and DI14 82 (800 hp). The instructions apply to this engine type in *program 96* with effect from engine number 5 564 900.

The engines are direct-injection, liquid-cooled, four-stroke, V8 diesel engines with 2 turbochargers. This engine has 2 charge air coolers connected to the internal cooling system and a charge air cooler cooled by seawater, see also page 10.

The engines feature an internal cooling system with a heat exchanger cooled by seawater.

The engine type has electronic control of the injection system's governor to optimize engine performance and such important operating factors as fuel consumption and exhaust emissions. Called DEC2 (Digital Electronic Control), the electronic control system is described in greater detail on page 12.

A common application is as the propulsion unit in larger leisure boats.

The normal output setting of the engine (performance code) is indicated on the type plate, see page 10.

Note Only standard components are described in the instruction manual. For special equipment we would refer you to the appropriate manufacturer's instructions.

In order to obtain the best value and service life from your engine, there are several points to bear in mind:

- Read through the Instruction Manual before starting to use your engine. Even those experienced with Scania engines may find new information in this manual.
- Follow the maintenance instructions. Maintenance carried out according to these instructions forms the basis of reliable operation and a long service life.
- *Pay special attention to the safety information beginning on page 6.*
- Get to know your engine so that you know what it can do and how it works.
- When necessary, always turn to an authorised Scania workshop. These have special tools, genuine parts and staff with training and practical experience of Scania engines.

Note Always use genuine Scania parts in service and repair to keep the engine operating correctly.

The particulars in this manual were applicable at the time it was printed. We reserve the right to introduce changes without prior notice.

! Important

During the warranty period, only use genuine Scania parts in service and repair for the warranty to be valid.

Scania CV AB
 Industrial and Marine engines
 S-151 87 Södertälje

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ENVIRONMENTAL RESPONSIBILITY

Scania has always been at the forefront in the development and production of environmentally safe engines.

We have made great progress in reducing harmful exhaust emissions to be able to meet the stringent emission standards that are mandatory for almost all markets.

We have done this without compromising the high quality of Scania industrial and marine engines in terms of performance and cost effective operation.

To maintain these superior properties throughout the life of the engine it is important that the operator/owner follows the instructions of this manual as regards operation, maintenance and choice of fuel and lubricants.

To further contribute to protecting the environment in service, maintenance and repair, ensure that harmful waste (oil, fuel, coolant, filters, batteries etc.) is disposed of and destroyed according to applicable local regulations.

This operator's manual contains highlighted text urging you to protect the environment in different service and maintenance operations.

Refer to example



Mind the environment!

Always use suitable containers to avoid spillage when bleeding systems or renewing components.

CERTIFIED ENGINES

An emission certified engine has been approved according to a specific certification standard. The certified engines delivered by Scania meet the most compelling emission standards in the European (EU) and non-European (USA) markets.

Scania guarantees that all engines of a certified engine type that are delivered, correspond to the engine approved for certification.

The engine is fitted with a certification plate, stating according to which certification rules (standard) the engine has been approved. Refer to page 10.

The following is required for the engine to meet the emission standards after being commissioned:

- *Service and maintenance must be performed according to this Operator's Manual.*
- *Only genuine Scania parts must be used.*
- *Service work on the injection equipment must be performed by an authorized Scania workshop.*
- *The engine must not be modified with equipment not approved by Scania.*
- *Seals and setting data may only be broken/modified after approval by Scania, Södertälje. Changes should only be made by qualified personnel.*
- *Changes affecting the exhaust system and intake system must be approved by Scania.*

Otherwise, follow the instructions in this manual for operation, care and maintenance of the engine. Also observe the safety precautions described in the following four pages.

Important! *If service and maintenance are not performed as stated above, Scania cannot guarantee that the engine corresponds to the certified configuration and will not assume liability for any damage occurring.*

SAFETY DETAILS

General

This Operator's Manual contains safety information that must be observed in order to avoid personal injuries and damage to the product or property. Refer to page 1.

The text boxes to the right on the pages provide information that is important for the proper operation of the engine and to avoid damage to the engine. Failure to follow these instructions may void the warranty.

Refer to example. →

! Important

Only use Scania genuine fuel filter.

Corresponding texts may also appear in the text column, headed **Caution!** or **Important**

The warning text in text boxes to the right on the pages provided with a **warning triangle** and headed **WARNING** is *extremely important* and warns of serious defects to the engine or improper handling that may lead to personal injury.

Refer to example →

 **WARNING**

Immobilise the starting device when working on the engine. If the engine starts out of control, there is a **SERIOUS RISK OF INJURY.**

The safety precautions that must be observed in the operation and maintenance of Scania engines are compiled on the following three pages. The corresponding text is also often stated next to the maintenance step concerned, shown with different degrees of significance as described above.

All items are marked with a **!** to highlight the importance of reading each item in the section.

A general safety rule is that no smoking is allowed:

- Near the engine and the engine bay
- When refuelling and near the filling station
- When work is performed on the fuel system
- Near flammable or explosive materials (fuel, oils, batteries, chemicals etc.)

Safety precautions for operation

! Daily inspection

Always perform visual inspection of the engine and engine bay before the engine is started and when the engine has been stopped after operation.

This will make it easy to detect any leakage of fuel, oil or coolant or any other abnormal condition that may require remedial action.

! Refuelling

When refuelling, there is a risk of fire and explosion. The engine must be stopped and smoking is not allowed.

Do not overfill the tank, since the fuel may expand, and close the fuel filler cap properly.

Only use fuel recommended in the service literature. Fuel of an incorrect grade may cause malfunctions or stoppage by interfering with the operation of the fuel injection pump and the injectors.

This could cause engine damage and possibly personal injury.

! Harmful gases

Only start the engine in a properly ventilated area. The exhaust emissions contain carbon monoxide and nitrogen oxides that are toxic.

When operating the engine in an enclosed area, an effective extraction device for exhaust gases and crankcase gases must be used.

! Starter lock

If the control panel is not fitted with a key switch, the engine bay should be fitted with a lock to prevent unauthorized starting of the engine.

Alternatively, a lockable main switch or battery master switch may be used.

! Starting spray

Never use starting spray or similar as a starting aid. An explosion may occur in the intake pipe, which could cause personal injury.

! Operation

The engine should not be operated in environments with surrounding explosive materials since electrical or mechanical components of the engine may emit sparks.

It is always a safety hazard to be near an engine that is running. Body parts or clothing, or a dropped tool may get stuck in rotating parts, such as the fan, causing bodily injury.

Always cover rotating parts and hot surfaces as much as possible to ensure personal safety.

Safety precautions for handling materials

! Fuel and lubrication oil

All fuels and lubricants as well as many chemicals are flammable. Always follow the instructions stated on the container.

All work on the fuel system must be performed when the engine is cold. Fuel leakage and spillage on hot surfaces may cause fire.

Store drenched rags and other flammable materials in a safe way to avoid spontaneous combustion.

! Batteries

Batteries, particularly when being recharged, emit highly flammable fumes that can explode. Do not smoke or let open flame or sparks come near the batteries or the battery compartment.

Incorrect connection of a battery cable or jump start cable may cause a spark, which in turn may cause the battery to explode.

! Chemicals

Most chemicals, such as glycol, corrosion inhibitors, preservation oils, degreasers etc. are hazardous. Always follow the safety precautions stated on the container.

Some chemicals, e.g. preservative oil, are flammable.

Always store chemicals and other hazardous materials in approved and distinctly marked containers and out of reach of unauthorized persons. Always dispose of superfluous or used chemicals through an authorized waste disposal contractor.

Safety precautions for care and maintenance

! Stop the engine

Always stop the engine before any maintenance and service work unless otherwise stated.

Prevent unauthorized starting by removing the starter key and turning off the power by the main switch or the battery disconnect switch, locking it in the off position. Also attach a warning tag, stating that work on the engine is in progress, at a suitable location.

It is always a safety hazard to work on an engine that is running. Parts of your body or clothing, or a dropped tool may get stuck in rotating parts, causing bodily injury.

! Hot surfaces and fluids

A hot engine always presents a risk of scalding. Always take care not to touch the exhaust manifold, turbocharger, oil pan, hot coolant and oil in pipes and hoses.

! Lifting the engine

Use the engine lifting eyes when lifting the engine. First check that the lifting equipment is in proper condition and has sufficient lift capacity rating.

Auxiliary equipment fitted to the engine may cause the centre of gravity to be displaced. Thus, additional lift devices may be required in order to provide proper balance and a safe lift.

Never work below a suspended engine!

! Batteries

Batteries contain a highly corrosive electrolyte (sulphuric acid). Always take care to protect your eyes, skin and clothing when charging and handling batteries. Wear protective gloves and goggles.

If electrolyte splashes on the skin, wash the affected part of the body with soap and plenty of water. If electrolyte splashes into the eyes, rinse eyes immediately with plenty of water and seek medical attention.

Dispose of used batteries through an authorized waste disposal contractor.

! Electrical system

Before work is performed on the electrical system, turn off the power by the main switch or the battery disconnect switch.

Also disconnect any external power supply to auxiliary equipment on the engine.

! Arc Welding

Before welding near or on the engine, remove the battery and alternator cables. Also remove the control unit connector.

Connect the weld clamp to the component to be welded, close to the weld location. Never connect it to the engine or in such a way that the current can pass through a bearing.

After the welding is completed, connect the cables to the alternator and the control unit before connecting the batteries.

! Lubrication system

Hot oil may cause scalding and skin irritation. Avoid skin contact with hot oil.

Make sure that the pressure in the lubrication system is relieved before work is carried out. Never start or operate the engine with the oil filler cap removed since oil will be ejected forcefully.

Dispose of used oil through an authorized waste disposal contractor.

! Cooling system

Never open the coolant filler cap while the engine is hot. Steam and hot coolant can come out forcefully and cause scalding.

If the cooling system must still be opened or disassembled while the engine is hot, open the filler cap very cautiously and slowly to release the pressure before the cap is removed. Use gloves since the coolant is still very hot.

Dispose of used coolant through an authorized waste disposal contractor.

! Fuel system

Always use gloves when checking for leaks in or performing other work on the fuel system. Always wear eye protection when testing injectors.

Fuel escaping under high pressure can penetrate body tissue and cause serious injury.

Never use non-genuine parts in the fuel system and the electrical system. Genuine parts are designed and manufactured to minimize fire and explosion hazard.

! Before starting

Install any guards that have been removed before the engine is started. Check to ensure that no tools or other objects have been left on the engine.

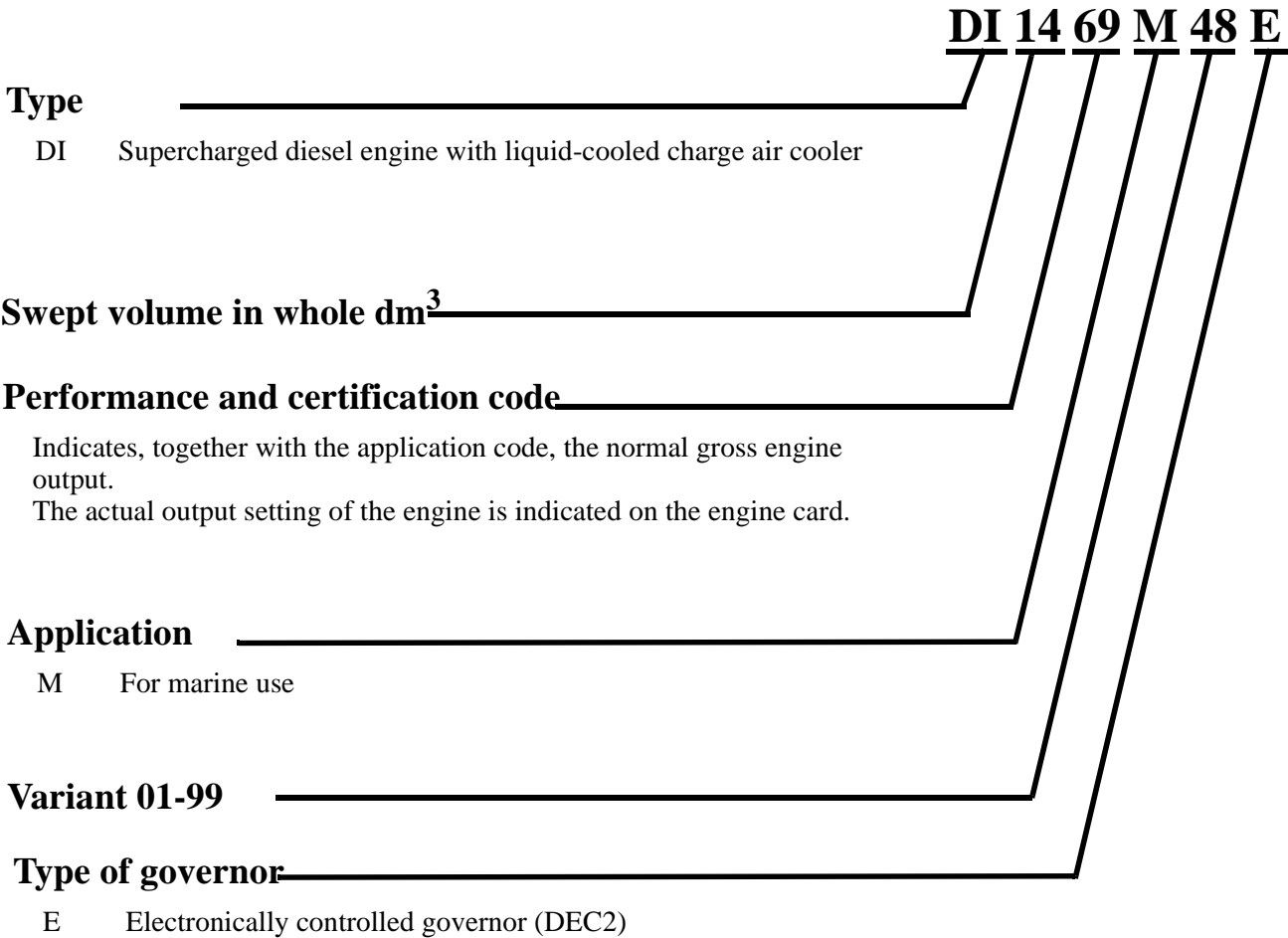
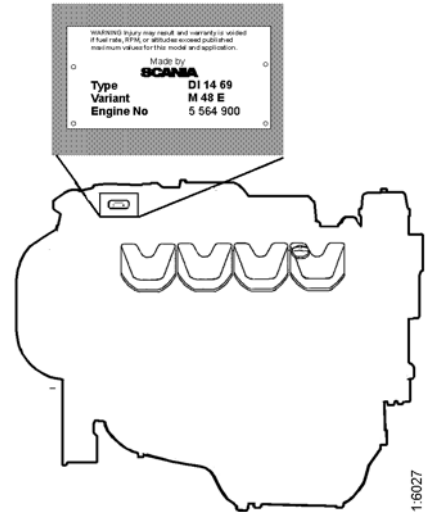
Never start the engine unless the air filter is installed. Otherwise there is a risk of objects entering the compressor wheel or a risk of personal injury from contact with it.

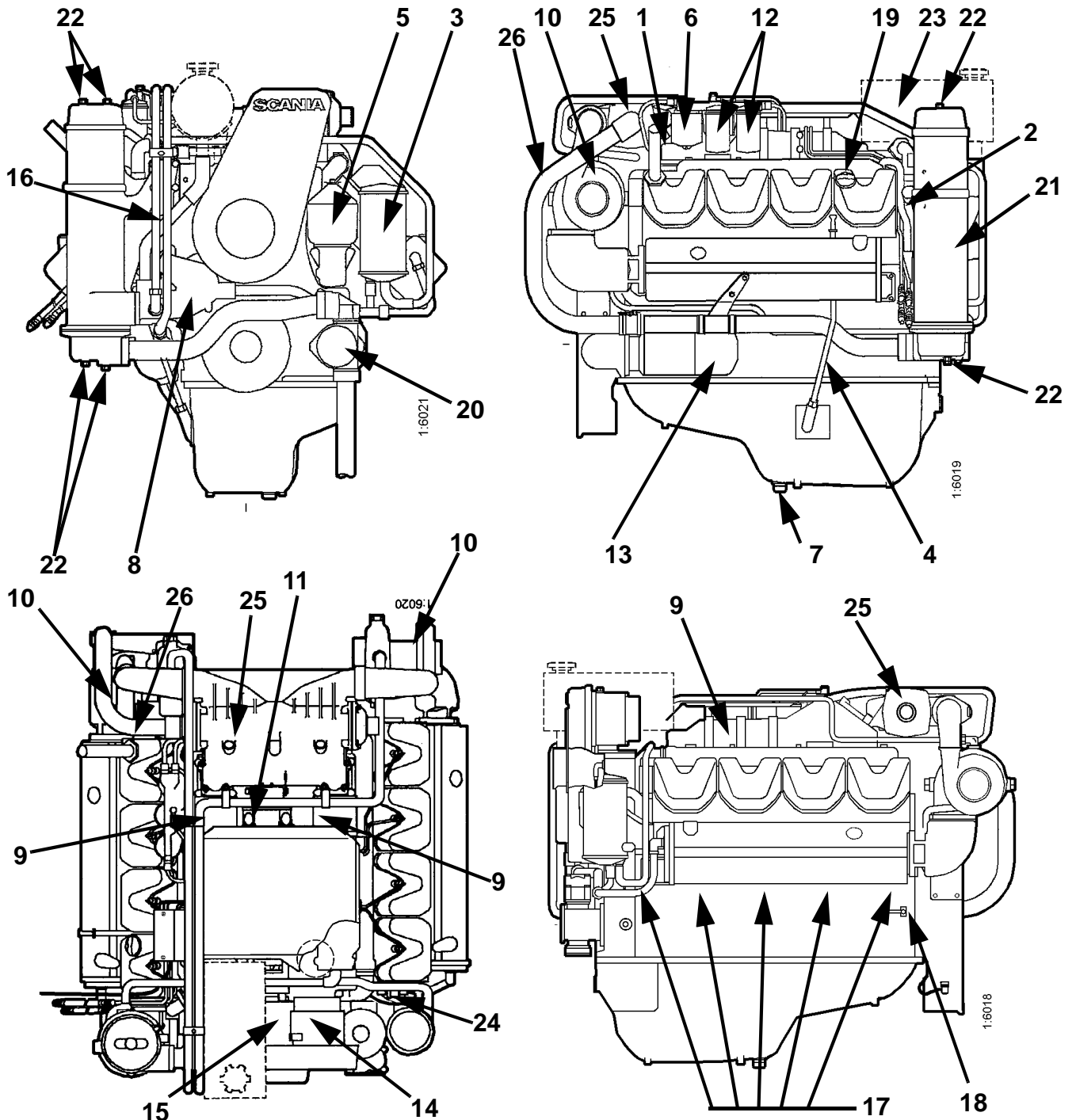
TYPE DESIGNATIONS

The engine designation indicates, in the form of a code, the type of engine, its size and intended use, etc.

The type designation and engine serial number are indicated on a type plate affixed to the right-hand side of the engine. The serial number is also punched in the engine block, adjacent to the first cylinder head. Refer to the illustration.

Engines that are certified regarding smoke and emissions are fitted with a certification plate specifying the documents they conform to. The plate is fitted to rocker cover number four from the front on the right hand side.





The illustrations show a typical D14 69 engine configuration.
Your engine may have different equipment from the one shown.

- | | | |
|--|------------------------------------|---|
| 1. Type plate | 10. Turbocharger | 20. Seawater pump |
| 2. Engine serial number, punched in engine block | 11. Injection pump | 21. Heat exchanger |
| 3. Oil cooler | 12. Fuel filter | 22. Sacrificial anodes |
| 4. Oil dipstick | 13. Starter motor | 23. Expansion tank with pressure cap |
| 5. Oil cleaner | 14. Alternator | 24. Oil pressure monitor |
| 6. Oil filter, turbo | 15. Fan belt, adjuster | 25. Charge air cooler (seawater-cooled) |
| 7. Drain plug, engine oil | 16. Coolant pipes to turbo | 26. Seawater pipe to charge air cooler |
| 8. Coolant pump | 17. Inspection holes, engine block | |
| 9. Charge air cooler (engine coolant-cooled) | 18. Drain cock, coolant | |
| | 19. Oil filler cap | |

DEC2 CONTROL SYSTEM

This engine has an injection pump with an electromagnetic actuator which adjusts the control rack to give the correct amount of fuel.

The system which controls the pump is called DEC2 (Digital Engine Control, generation 2).

The control unit (DEC2) continuously receives signals from sensors for engine speed, charge air temperature and pressure, coolant temperature, oil pressure, throttle position and control rack travel in the injection pump. Using this input data and a control program, the correct amount of fuel for the current operating conditions can be calculated.

The system's sensors may be used only for DEC2, *not for other instruments or other monitoring purposes.*

The control unit contains monitoring functions to protect the engine in the event of a fault which would otherwise damage it. Faults and the more important monitoring functions are indicated on the control unit in the form of light emitting diodes. See illustration on page 14 for a description.

In case of a fault, the **Power** - or **Shutdown** indicator on the DEC2 control unit as well as the main indicator lamp on the main supply box and the instrument panel will illuminate.

If a fault has been indicated on the main indicator lamp the operator can determine the cause of the fault with the help of the LEDs on the control unit and the troubleshooting schedule on page 17, and carry out the required investigation and remedy.

Depending on the nature of the fault, the control system will take different actions to protect the engine such as reducing the power output, keeping the engine running at a constant low speed or, in case of a function impairing fault, shutting down the engine (*Shutdown*).

To enable readout of LED fault codes there is a lamp test/fault code switch located in the main supply box near the control unit.

A PC based program is also available to help service personnel to detect and rectify faults and to adjust certain parameters in the operating program.

Diagnostics and changes to programs must only be performed by authorized personnel.

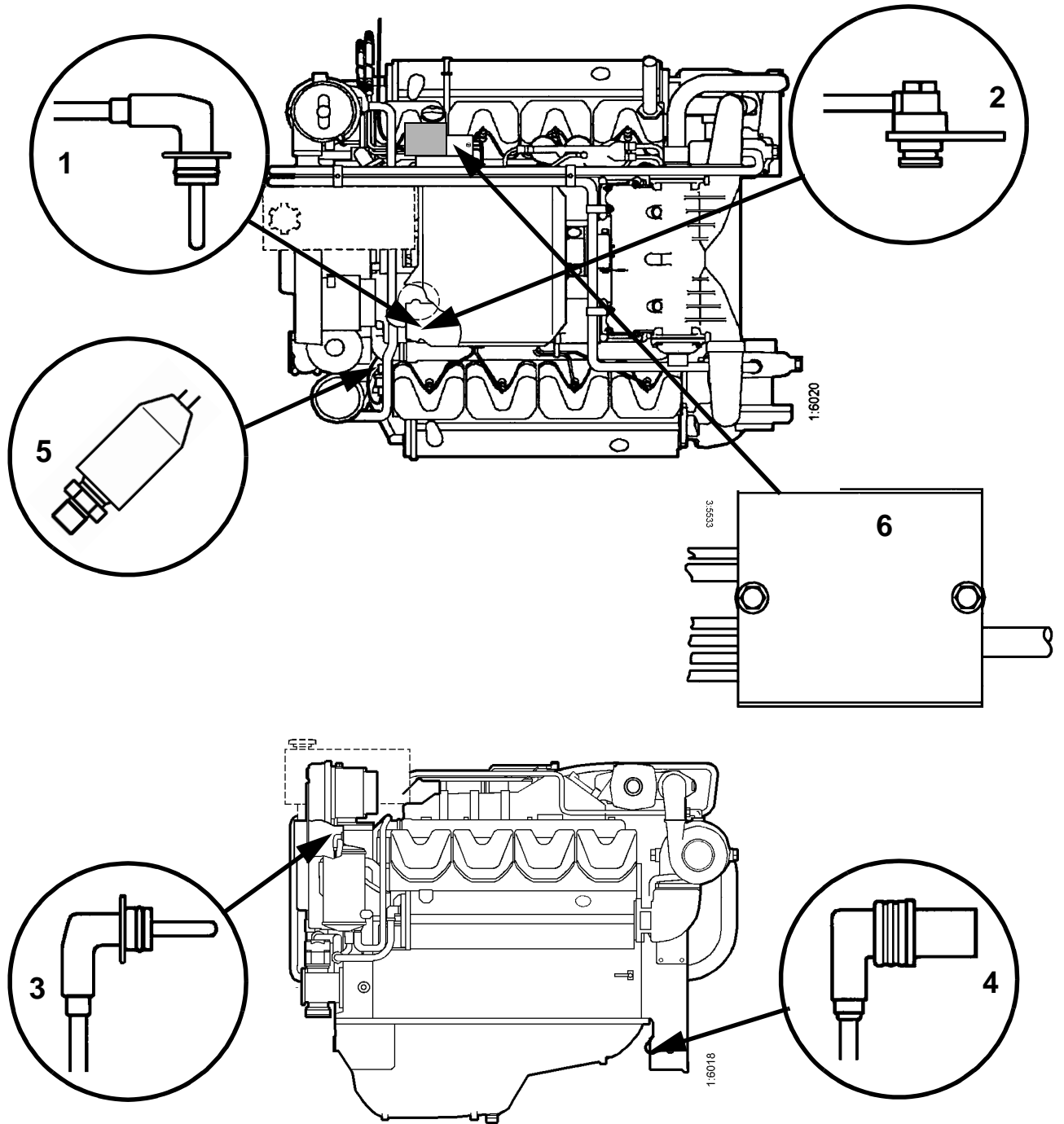
The locations of the sensors and monitors that send signals to the control unit are shown in the illustrations on pages 13.

There is a description of the functions of the LEDs during normal operation on page 14.

On page 15 there is a description of the functions of the LEDs in case of a fault and actions in case of **Power-** and **Shutdown** indication.

Troubleshooting and fault code reading are described on pages 16 and 17.

Location of sensors for DEC2



1. Connection of lead to charge air temperature sensor
2. Charge air temperature sensor
3. Coolant temperature sensor
4. Engine speed sensors
5. Oil pressure monitor
6. Connector panel

LED functions during normal operation

Note: The lamp test/fault code switch should not be depressed. All LEDs come on briefly when the control unit is powered up.

CONTROL STATUS

- ✱ The LED flashes continuously when the control unit is supplied with current, regardless of whether the engine is running or not.

SHUTDOWN

- The LED is out.

STARTING

- ✱ The LED lights up as soon as the engine turns over on cranking and follows the programmed starting sequence until it has been completed and then goes out.

RUNNING

- ✱ The LED comes on when the engine has started and the "Starting" LED goes out. It remains on until the engine is stopped.

TORQUE LIMIT

- ✱ The LED comes on when the control unit detects that the engine has received the maximum permissible quantity of injected fuel according to its power curve. This means 100% power output at the current rpm. If the load increases, engine rpm will decrease.

BOOST LIMIT

- ✱ The LED comes on when the control unit smoke limiter restricts the maximum fuel quantity. Operation of the smoke limiter is dependent on the charge air pressure.

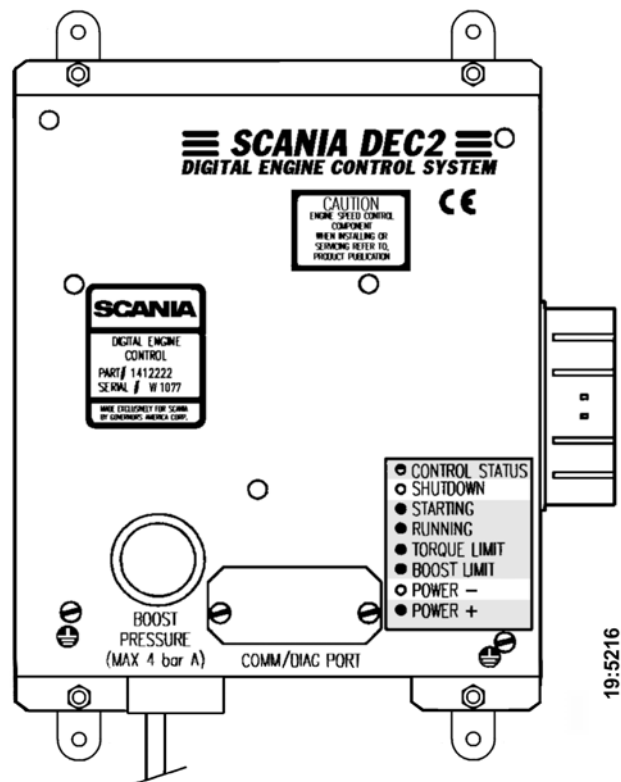
POWER-

- The LED remains out during normal operation as long as no fault is detected by the control unit. See next page for the procedure to be adopted in the event of a fault.

POWER+

- ✱ If the control unit is programmed to allow the engine to be operated according to more than one power/torque curve (map), the following applies.

The LED comes on when the engine is run at more than 100% power output (MAP 2). It goes out when the engine returns to the 100% power output curve (MAP 1) or when the power output required is less than 100%.



Action in case of a fault

LED indications in case of a fault

Note The main indicator lamp in the main supply box and at the instrument panel has indicated a fault. The lamp test/fault code switch should not be depressed.

CONTROL STATUS

- ✱ The LED will continue to flash even in case of a fault as long as voltage is supplied to the control unit.

POWER -

- ✱ If the LED comes on, the control unit has detected a defect that could cause damage to the engine if operation continues.

The control unit automatically reduces engine power output to a predefined level if the corresponding function has been selected.

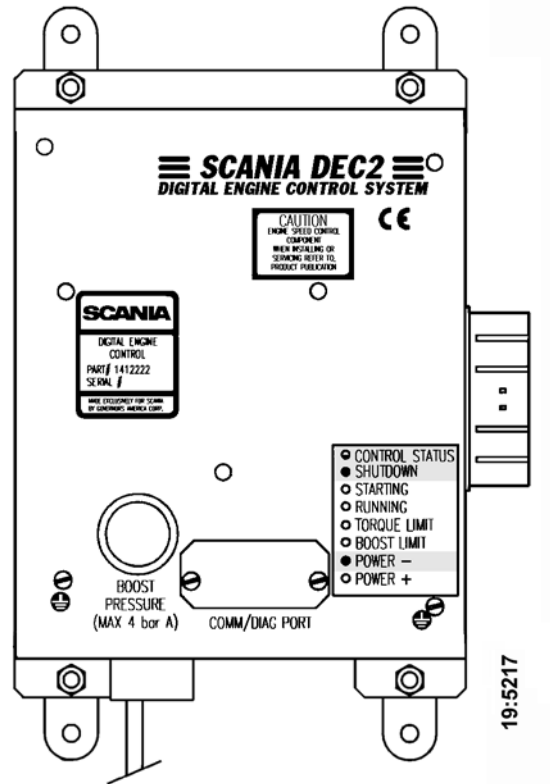
Action: Reduce engine speed to idle if possible and conduct troubleshooting according to instructions on page 16 and the chart on page 17

SHUTDOWN

- ✱ The LED comes on and the *engine is switched off automatically* in case of a severe fault that could cause damage to the engine if operation continues.

Action: Conduct troubleshooting according to instructions on page 16 and the chart on page 17

If the engine has not stopped, reduce engine speed to idle and conduct troubleshooting.



Changing functions using the DIP switches in the control unit

There are 8 DIP switches in the control unit under the round black rubber cover.

These switches shall be in the *ON* position to obtain normal functions according to the operating program. However, for single-speed engines, the normal position of DIP switches 6, 7, and 8 may also be *OFF*

Shutdown at threshold values for low oil pressure and high coolant temperature can be selected by setting DIP switch **4** to *OFF*

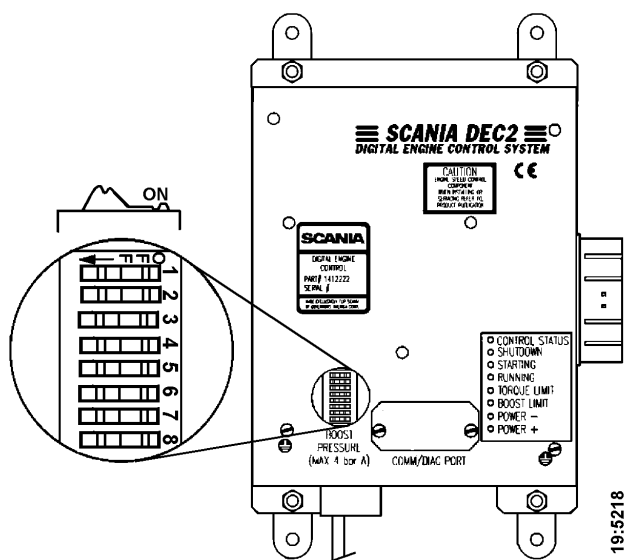
With DIP switch **4** in position *ON*, **Power-** indication is obtained for these threshold values. Engine output reduction (*LOP*) can be selected to prevent damage to the engine. Changes to the program must only be performed by authorized personnel.

Note Do not operate the engine with a **Power-** indication except for in emergencies.

Readout of fault codes

Note If the engine has stopped or lost power but the main indicator lamp is out and neither **POWER-** nor **SHUTDOWN** are on, the fault is outside the control unit detection range. Probable causes: fuel shortage, temporary overload, mechanical fault.

- Activate the lamp test/fault code switch. In Scania electrical equipment the main indicator lamp is located in this switch on the main supply box.
- All LEDs will then come on for 2 seconds to indicate that they are intact and in working order. This also applies to the main indicator lamp in the main supply box and the instrument panel. Make a note of any LED that is defective.
- All LEDs will then be out for approximately 4 seconds.
- Following this, a fault code will be indicated on one of the LEDs for 2 seconds. Note which LED it is.
- The control unit then resumes the operating mode automatically.
- After having made a note of the fault code, reset the lamp test/fault code switch and reset the control unit by turning off its power supply momentarily.
- The most probable cause of the fault can then be found in the trouble shooting schedule on the next page.
- When the fault or faults have been rectified the engine can be restarted.
- If the control system continues to indicate a fault by way of the main indicator lamp, further faults may have been recorded. The fault code readout must then be repeated as per above since the system can only display one fault code at a time.
- The fault(s) will be stored in a special memory in the control unit along with information about the operating time when it(they) occurred. Stored faults can be accessed and erased by authorised service personnel.



The DIP switches are showed in ON position

<p align="center">READOUT OF FAULT CODES LED INDICATION WHEN THE LAMP TEST/FAULT CODE SWITCH IS ACTIVATED</p>							
					Probable cause	Action	
CONTROL STATUS	SHUTDOWN	STARTING	RUNNING	TORQUE LIMIT	BOOST LIMIT	POWER -	POWER +
*							
	*	*					
			*				
				*			
			*				
						*	
							*
							*
							*
							*
							*

* = LED on

STARTING AND RUNNING

AT FIRST START

When the engine is started for the first time, the maintenance points listed under "First start" in the maintenance schedule should be followed, see page 25.

Since these points are important for the engine to work satisfactorily right from the start, they are also listed below.

1. Checking oil level (see page 27).
8. Checking coolant (see page 32).

The coolant should contain anti-corrosive to protect the cooling system from corrosion.

If there is a danger of freezing:

- Only glycol anti-freeze should be used in the coolant as protection against corrosion. We recommend only *nitrite-free* glycol anti-freeze with the following supplier designations:

BASF G48 or BASF D542

- The concentration of glycol should be **30 - 50% by volume** depending on ambient temperature. 30% by volume offers protection down to -18 °C. See page 32.
- *Never top up with water only or glycol only. Lost fluid should always be replaced with pre-mixed coolant with the same glycol content as the coolant in the engine. If the concentration of glycol drops, both anti-freeze and corrosion protection will suffer.*

Note: A glycol concentration below 30% by volume will not provide sufficient protection against corrosion. A glycol concentration greater than 50% will not increase anti-freeze protection and reduces engine cooling capacity.

If there is no danger of freezing:

- Only *Scania Anti-corrosive* should be used in the coolant to protect against corrosion. The correct level of anti-corrosive is 7-12% by volume and this must never drop below 7% by volume. The inhibitor in *Scania Anti-corrosive* is nitrite-free.
- First fill: Fill with *Scania Anti-corrosive* as indicated on the packaging.
- *Never top up with water only or anti-corrosive only. Lost fluid should always be replaced with pre-mixed coolant: water + 10% Scania Anti-corrosive by volume.*

Coolant filter

Only coolant filter *without inhibitor* may be used. The use of a coolant filter increases the life of the coolant and reduces the risk of deposit corrosion.

Coolant composition:

If there is a danger of freezing:
 minimum 30% glycol by volume
 maximum 60 % glycol by volume

If there is no danger of freezing:

7-12% by volume
Scania Anti-corrosive
 (no glycol)



WARNING

Ethylene glycol and corrosion inhibitor, if swallowed can be fatal.

Avoid contact with the skin.

! Important

The recommended glycol must not be mixed with glycol having nitrite-based anti-corrosive.


! Important

The use of too much *Scania Anti-corrosive* as mixed with glycol may cause deposits.

! Important

If a coolant filter has been fitted it must not contain inhibitor.

- 12. Checking fuel level (see page 41).
- 15. Checking electrolyte level in batteries (see page 43).
- 16. Checking battery charge (see page 43).
- 18. Checking coolant level monitor (see page 44).
- 19. Checking V-belt tension (see page 45).



WARNING

Immobilise the starting device when working on the engine. If the engine starts out of control, there is a SERIOUS RISK OF INJURY.

CHECKS BEFORE RUNNING

Before running, "Daily maintenance" as described in the maintenance schedule should be carried out, see page 25.

STARTING THE ENGINE

If the fuel tank has been run dry or if the engine has not been used for a long time, bleed the fuel system, see page 41.


Out of consideration for our common environment, your new Scania engine has been designed to start using a smaller amount of fuel. Unnecessarily large amounts of fuel used for starting the engine always result in the discharge of unburnt fuel.

- Open the seawater system's intake valve (if fitted).
- Open the fuel cock (if fitted).
- Disengage the engine.
- Engines with battery master switch: Switch on the power using the battery master switch.
- DEC2: If the main indicator lamp comes on or flashes when the power is turned on, this indicates the presence of a fault in the control system or engine which must be found and rectified before the engine is started. See page 16.
- Start the engine by means of the starter button or ignition key.

Starting at low temperatures


Local environmental requirements should be complied with. Start aids, engine heater and/or flame start should be used to avoid starting problems and white smoke.

To limit white smoke, the engine should be run at low speed and under moderate load. Avoid running it longer than necessary at idling speed.



WARNING

Only start the engine in a properly ventilated area. When operating the engine in an enclosed area, an effective extraction device for exhaust gases and crankcase gases must be used.



WARNING

Never use starting spray or similar as a starting aid. An explosion may occur in the intake pipe, which could cause personal injury.

At temperatures below 0 °C:

Note: Use only start aids recommended by Scania.

- The starter motor may only be used for 30 seconds, after which it must rest for 2 minutes.

If the engine has flame start:

- Operating flame start *without timer relay*: Press the control button which also acts as a pre-glow button (max. 20 s). The glow plug continues to glow as long as the button is held down after the engine is started. Max. time is 5 minutes.
- Operating flame start *with timer relay*: Press the pre-glow button (max. 20 s). Release the pre-glow button after the engine starts. The timer relay keeps the glow plug working for 5 minutes. If a shorter on-time is required, press the release button. The key must be set to 0 if the start attempt fails.

Note: If the engine is equipped with an INTERLOCK switch, this switch should be depressed and held down until the oil pressure has reached a sufficiently high level.

- Run the engine until warm with a light load. A light load on a cold engine gives better combustion and faster heating than warming up with no load.

! Important
Maximum starter engagement time is 30 seconds. Risk of overheating. Allow starter to cool for 2 minutes after a starting attempt before cranking again.

RUNNING

Check instruments and warning lamps at regular intervals.

Engine speed

The Scania tachometer is divided into different coloured sectors as follows.

0-500 rpm	red area:	prohibited engine speed, passed when stopping and starting.
500-700 rpm	yellow area:	low idle.
700-2200 rpm	green area:	normal operating speed. The engine's operating speed range is controlled by the DEC2 control system.
2200-2600 rpm	yellow/green striped:	unsuitable operating speed. May occur when switching off
2600-3000 rpm	red area:	prohibited engine speed

Cruising speed

Important: *To achieve good operating economy and long engine life, cruising speed should be about 200 rpm below maximum engine speed.*

Coolant temperature

Normal coolant temperature when the engine is running should be 70 - 90 °C.

DEC2: If the temperature is too high, 98 °C or above, the control system will reduce engine power (**Power -**) in order to lower the temperature.

If the temperature continues to rise, the engine will be stopped automatically (**Shutdown**) at 103 °C.

Excessively high coolant temperature can damage the engine.

If run for extended periods under an extremely light load, the engine may have difficulty in maintaining normal operating temperature. However, the temperature will rise to a normal level again when the load on the engine is increased.

Oil pressure

Max. oil pressure:

warm engine at speed above 800 rpm 6 bar

Normal oil pressure:

warm engine at operating speed 3 - 6 bar

Min. oil pressure:

warm engine at 800 rpm 0.7 bar

At speeds below 800 rpm, the gauge may show low oil pressure without there being a fault.

Oil pressure below 0.7 bar at speeds above 800 rpm will cause engine damage. The engine must be stopped immediately.

**High lubrication oil pressure
(above 6 bar) is normal when
starting a cold engine.**

Charge warning lamp

If the lamp lights during operation:

Check/adjust the alternator drive belts as described under maintenance point See page 45. If the charge warning lamp is still lit, there may be a fault in the alternator or in the electrical system.

STOPPING THE ENGINE

1. Allow the engine to run without load for a few minutes if it has been run with a high continuous load.
2. Stop the engine with the stop button. Keep the stop button depressed until the engine is completely stationary.
3. DEC2: Before switching off, check that the control system's main indicator lamp is not on or flashing. See page 9 for trouble shooting.
4. Engines with battery master switch: turn off the current using the battery master switch.
5. Set the control switch to "0".

! Important

**There is danger of turbo damage
and post boiling if the engine is
stopped without cooling.**

! Important

**The power must not be switched
off before the engine has
stopped.**

CHECKS AFTER RUNNING

- Check that the power is cut with the battery master switch and that the control switch is set to "0".
- Fill the fuel tank. Make sure that the cap and the area around the filler opening are clean to avoid contamination of the fuel.
- If there is a risk of freezing, the cooling system must be drained if it does not contain sufficient anti-freeze, see page 32.
- Close intake valve for seawater (if fitted).
- *If there is a danger of freezing, the seawater must also be drained .*
- At temperatures below 0 °C: Prepare for the next start by connecting the engine heater (if fitted).



WARNING

**Immobilise the starting device when working on the engine.
If the engine starts out of control, there is a
SERIOUS RISK
OF INJURY.**



! Important

Top up engine coolant when the engine has been stopped after being started for the first time.

MAINTENANCE

The maintenance programme covers 22 points, divided into the following main groups:

- Lubrication oil system page 26
- Cooling system page 30
- Air cleaner page 39
- Fuel system page 41
- Electrical system, monitors, batteries, etc. . . page 43
- Miscellaneous page 45

The maintenance points are divided into intervals as follows:

Daily maintenance

Maintenance before first start

Maintenance after the first 400 hours of operation


Periodic maintenance every 200 hours of operation (carried out after 200, 400, 600, 800, etc. hours)

Periodic maintenance after every 400 hours of operation (carried out after 400, 800, 1,200, 1,600, etc. hours)

Periodic maintenance after every 1,200 hours of operation (carried out after 1,200, 2,400, 3,600, etc. hours)

Maintenance every year

Maintenance every 3rd year



WARNING

Immobilise the starting device when working on the engine. If the engine starts out of control, there is a SERIOUS RISK OF INJURY

ENGINES WITH FEW HOURS OF OPERATION

The engine is run to operating temperature and the maintenance points below should be carried out:

1. Checking oil level.
5. Checking coolant level.
10. Checking low pressure indicator.
12. Checking fuel level.
15. Checking electrolyte level in batteries.
16. Checking battery charge.
17. Cleaning batteries.
20. Look for leaks. Remedy as necessary

! Important

For engines with few operating hours which do not receive periodic maintenance according to the maintenance schedule on page 25, maintenance should be carried out according to the schedules for:

“Every year”

MAINTENANCE SCHEDULE

	Daily	First time at		Interval			At least	
		At first start	400 h	200 h	400 h	1200 h	Every year	Every 3rd year
LUBRICATION OIL SYSTEM, page 26								
1. Checking oil level	●	●						
2. Oil change				●1			●	
3. Cleaning the lubrication oil cleaner				●1			●	
4. Changing the turbo filter				●1			●	
COOLING SYSTEM, page 30								
5. Checking coolant level	●							
6. Checking corrosion protection rods 4)					●4		●	
7. Checking seawater pump impeller 4)					●4		●	
8. Checking coolant		●			●5		●5	
9. Cleaning cooling system						●1		●
AIR CLEANER, page 39								
10. Test reading low pressure indicator	●							
11. Cleaning or changing filter insert						●3		●
FUEL SYSTEM, page 41								
12. Checking fuel level	●	●						
13. Changing main filter						●1		●
14. Checking injectors						●		●
ELECTRICAL SYSTEM, page 43								
15. Checking electrolyte level in batteries		●		●2			●	
16. Checking charge state of batteries		●		●2			●	
17. Cleaning batteries				●2			●	
18. Checking level monitor		●			●		●	
MISCELLANEOUS, page 45								
19. Checking V-belts		●		●			●	
20. Look for leaks. Remedy as necessary	●							
21. Checking/adjusting valve clearance			●			●		
22. Changing (or cleaning) valve for closed crankcase ventilation						●		

1. More often if required
2. For engines with few operating hours, see page 24.
3. Earlier if low pressure indicator shows red.
4. Guiding value. Varies according to composition of seawater.
5. If inhibitor has not been topped up for three years, the coolant should be changed.

LUBRICATION OIL SYSTEM

OIL GRADE

The engine oil should **at least** meet the requirements for one of the following oil classifications:

- Service CE or CF as per API
- CCMC - D5
- Acea E3-96

- Check with your oil supplier that the oil meets these requirements.
- Specified oil change intervals apply under the provision that the sulphur content of the fuel does not exceed 0.3% by weight.
- Viscosities as illustrated.
- At very low outside temperatures: Consult your nearest Scania representative to avoid starting difficulties.

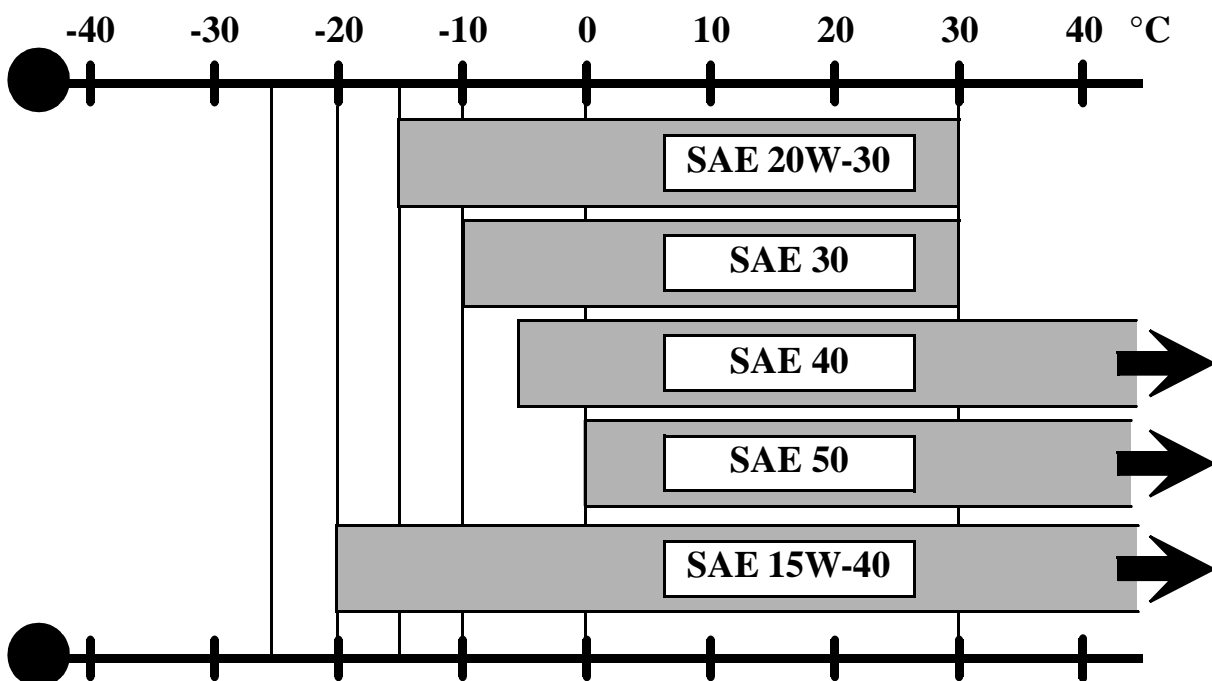
! Important
Additives must not be used.
The oil should be suitable for all temperature variations until the next oil change.

Oil analysis

Some oil companies can offer analysis of the engine oil. This analysis measures the oil's total base number (TBN), total acid number (TAN), fuel dilution, water content, viscosity and the content of wear particles and soot in the oil.

The result of a series of analyses forms the basis of establishing a suitable oil change interval.

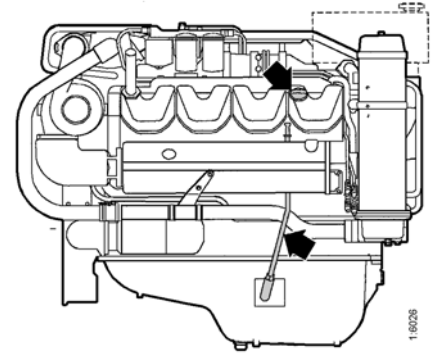
If the conditions are changed, a new oil analysis programme must be undertaken to establish a new change interval.



1. Daily: CHECKING OIL LEVEL

Before checking oil level: Let the engine remain stationary for at least 1 minute.

- The correct level is between the marks on the dipstick. Top up when the level is at the lower mark.
- Correct type, see "Oil grade", page 26.

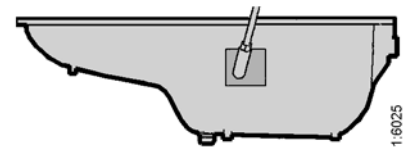


2. Every 200 hours: OIL CHANGE

If the engine is used in particularly demanding operating conditions, in an especially dusty environment or if the deposits in the centrifugal cleaner are thicker than 20 mm: Change the oil more often.

- Pump out the oil using the oil bilge pump when the engine is warm.
- Fill with new oil.
- Check the level on the dipstick.

Note: Observe the applicable environment protection regulations when disposing of the old oil.



Max. 30 dm³
Min. 25 dm³




Max. 26 dm³
Min. 20 dm³



WARNING

The oil may be hot.
Wear protective gloves and goggles



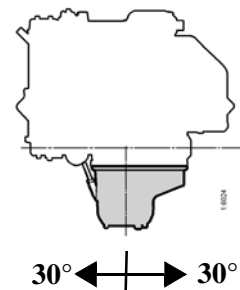
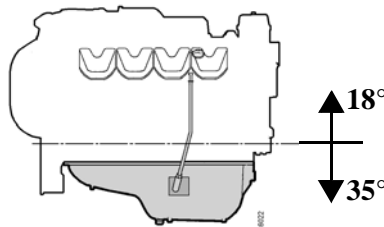
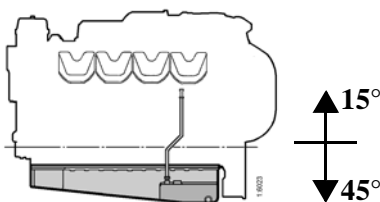
Mind the environment!

Always use a suitable container to avoid spillage when changing oil.
Dispose of used oil through an authorized waste disposal contractor.

Maximum oil sump angles of inclination when in operation

Maximum permissible angles for operation vary according to the type of oil sump, see figure.

Note: Given angles may only be used intermittently.



3. Every 200 hours: CLEANING THE OIL CLEANER (at same time as oil change)

- Unscrew the nut and remove the cover.



WARNING

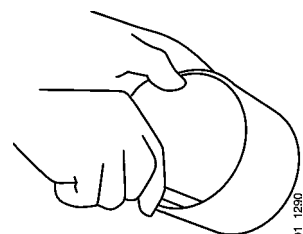
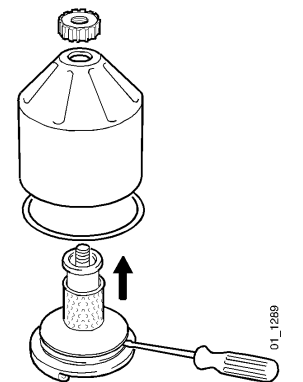
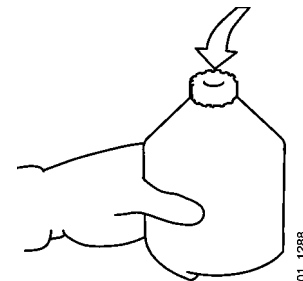
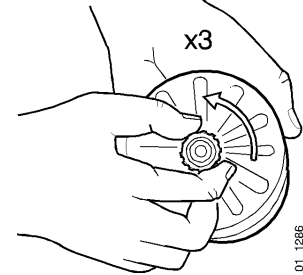
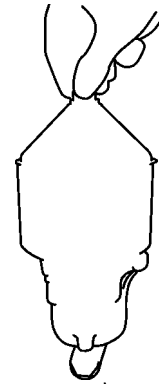
Open the cap carefully. The oil may be hot.

- Lift out the rotor and slacken the nut for the rotor cover three turns.
- If the nut is stuck:
Clamp the nut, *absolutely not the rotor*, in a vice and turn the rotor three turns by hand or using a screwdriver.

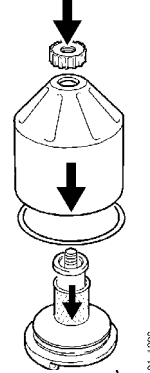
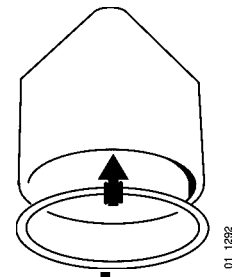
- Gently tap the nut using your hand or a plastic hammer so that the rotor bowl becomes detached from the bottom plate.

- Undo the nut and remove the rotor bowl.
- Carefully prise the strainer loose from the bottom plate.

- Scrape away deposits from the inside of the rotor bowl. If there are no deposits, this shows that the cleaner is not working.
- If the deposits are *thicker than 20 mm: Clean more often.*



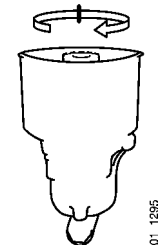
- Clean all the parts in diesel fuel oil.
- Place the O-ring in position in the rotor bowl. ***This must not be damaged.*** Change if necessary.
- Assemble the rotor



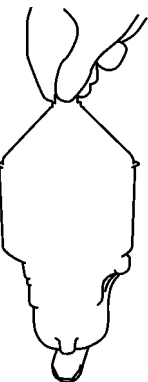
- Tighten the rotor nut hard by hand



- Refit the rotor.
- Check that it turns easily.



- Check that the O-ring in the bowl is not damaged. A hardened or damaged O-ring should be replaced.
- Screw down the bowl hard ***by hand.***



If the nut is tightened using a tool, the rotor shaft, nut or bowl may be damaged.

Operational test

The rotor turns very quickly and should continue to rotate when the engine has stopped.

- Stop the engine when it is warm.
- Listen for the whirring from the rotor or feel whether the cleaner housing is vibrating.

The rotor normally rotates for **30 - 60 seconds** after the engine has stopped.

If not: Dismantle and check.



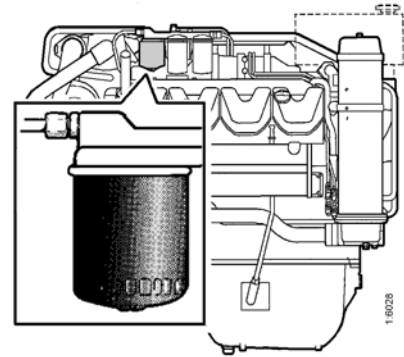
4. Every 200 hours:

CHANGING THE TURBO FILTER

(at the same time as the oil change)

- Remove the old filter and discard it according to environmental requirements.
- Oil the rubber gasket and fit a new genuine Scania filter.
- Tighten the filter by hand.
Never use tools as the filter may sustain damage, interfering with circulation.
- Start the engine and check for leaks.

If the deposits in the centrifugal cleaner exceed 20 mm, the turbo filter must be changed more often, at the same time as cleaning the centrifugal filter and changing the oil.



Mind the environment!

Always collect oil in a suitable container to avoid spillage when renewing the oil filter. Dispose of used filters through an authorized waste disposal contractor.

COOLING SYSTEM

5. Daily:

CHECKING COOLANT LEVEL

- Open the expansion tank cap and check the coolant level.
- *Correct level: (Scania expansion tank)*
 - Cold engine: The coolant should reach up to the bottom of the filler pipe.
 - Warm engine: The coolant should be 10 - 20 mm above the bottom of the filler pipe.
- Other types of expansion tank according to the installer's instructions.
- Top up coolant as necessary, see point 6.

Note: When filling large amounts of coolant:
Never pour cold coolant into a warm engine.
This could crack the cylinder block and head.



WARNING

Carefully open the cap.
Hot water and steam may blow out.



Important

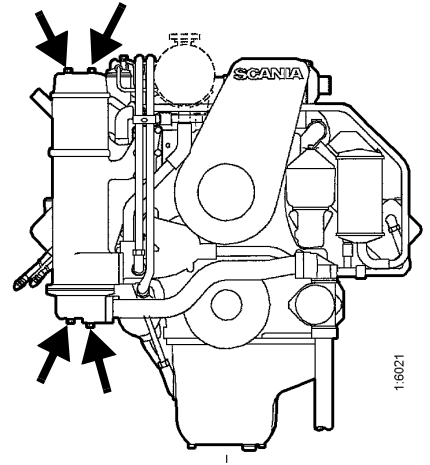
Always top up with ready mixed coolant.

6. Every 400 hours:

CHECKING CORROSION PROTECTION RODS

- Drain the seawater circuit and check the corrosion protection rods (sacrificial anodes). Location as per drawing on page 11.
- Scrape away all loose material from the anode.
- Change if less than half the rod remains.
New rods are 55 mm long, diameter 17 mm.

If the corrosion protection rods are highly eroded, they should be checked more often, e.g. every 200 hours.



1:6021

7. Every 400 hours:

CHECKING SEAWATER PUMP IMPELLER

- Close the bottom valve if the seawater pump is below the water line.
- Drain the seawater circuit.
- Remove the cover from the seawater pump.
- Check that the impeller vanes are not worn or damaged.

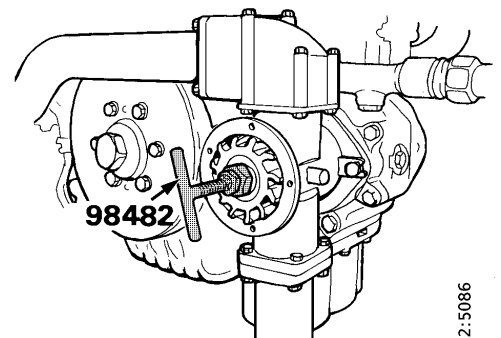
If the impeller often requires changing, it is necessary to improve the purity of the seawater.

Changing the impeller

- Extract the impeller using extractor 98 482 (Scania special tool).
- Fit a new impeller and the cover. Check that the cover seal is not hard or damaged.

Note: A spare impeller should be carried on board.

- The impeller can become deformed after long periods of standstill. Change before starting or remove the impeller before long periods of disuse. Also see “Mothballing”.



2:5086

8. Every 400 hours: CHECKING COOLANT

Coolant should be checked as follows:

- a) Check the appearance of the coolant.
- b) Coolant with glycol: Check the glycol content.
- c) Coolant with *Scania Anti-corrosive*: Check the corrosion protection.

The composition of the coolant is also described under “Starting and running”.

a) Checking the appearance of the coolant

- Take a little coolant in a vessel and check that it is clean and clear.
- If the coolant is contaminated or cloudy: Consider changing the coolant
- The water for the coolant should be free of dirt.
- Use drinking water with a pH of 6 - 9.

b) Checking glycol content

If there is a danger of freezing, use only glycol as protection against corrosion in the coolant.

- Cooling systems with glycol must contain at least 30% glycol by volume to offer sufficient protection against corrosion.
- 30% glycol by volume provides anti-freeze protection down to -16 °C. If more protection is required, see the table on the next page for calculating the necessary amount of glycol.

We recommend only *nitrite-free* glycol anti-freeze with the following supplier designations:

BASF G48 or BASF D542

- *Top up with glycol if the glycol content is less than 30% by volume. A glycol content greater than 50% by volume will not provide more anti-freeze protection.*
- The table shows the temperature at which ice (slush) starts to form. The engine freezes and breaks at significantly lower temperatures, see graph.
- Ice forming in the coolant often causes malfunction without any risk of damage. The engine must not be loaded hard when ice is forming.

Note: The coolant should be changed when the cooling system is cleaned: every 1,200 hours or at least every 3rd year.

Important: *If a coolant filter is used in the cooling system, it must not contain an inhibitor.*

Coolant composition:

If there is a danger of freezing:
at least 30% glycol by volume
max. 50% glycol by volume

If there is no danger of freezing:

7-12% by volume
Scania Anti-corrosive



WARNING

Ethylene glycol is highly dangerous if ingested and can prove fatal.
Avoid skin contact with glycol.

! Important

The coolant should be ready mixed when it is poured into the cooling system.
Never top up with only water or only glycol.

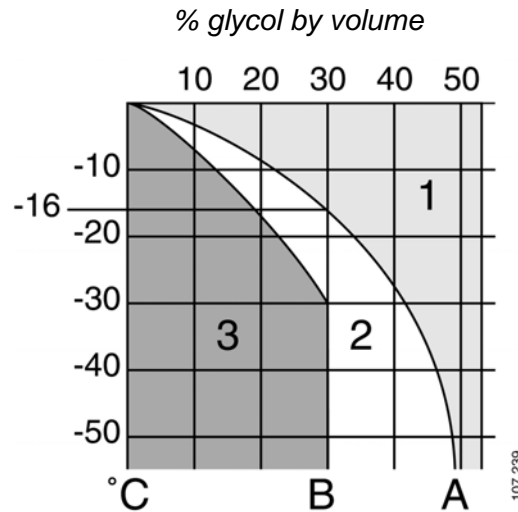
! Important

The recommended glycol must not be mixed with glycol having nitrite-based anti-corrosive.
Risk for build up of sludge and reduced cooling capacity.

Properties of glycol at low temperatures:

- Example with 30% glycol by volume
- Ice slush starts to form at -16°C.
- There is risk for malfunctions at -30°C

No risk of damage by freezing with a minimum content of 30% glycol by volume



Curve A: Ice build up starts (slush)

Curve B: Temperature at which damage due to freezing can occur

1. Safe range
2. Malfunctions may occur (ice slush)
3. Risk of damage by freezing

A

% glycol by volume	15	20	25	30	35	40	45	50	60	Cooling system capacity, dm ³
Ice slush starts to form at °C	-6	-9	-12	-16	-22	-27	-36	-46	-55	
Glycol dm ³ (litres)	5	6	8	9	11	12	14	15	18	30
	6	8	10	12	14	16	18	20	24	40
	8	10	13	15	18	20	23	25	30	50
	9	12	15	18	21	24	27	30	36	60
	11	14	18	21	25	28	32	35	42	70
	12	16	20	24	28	32	36	40	48	80
	14	18	23	27	32	36	41	45	54	90
	15	20	25	30	35	40	45	50	60	100
	17	22	28	33	39	44	50	55	66	110
	18	24	30	36	42	48	54	60	72	120
	20	26	33	39	46	52	59	65	78	130
	21	28	35	42	49	56	63	70	84	140
	23	30	38	45	53	60	68	75	90	150
	24	32	40	48	56	64	72	80	96	160
	26	34	43	51	60	68	77	85	102	170
	27	36	45	54	63	72	81	90	108	180
29	38	48	57	67	76	86	95	114	190	
30	40	50	60	70	80	90	100	120	200	

A = Range to be avoided. Only for calculation of glycol mix.

Freezing point of coolant when ice slush starts to form at different glycol mixes

b)

Checking Protection against corrosion

There must always be sufficient anti-corrosive (inhibitor) in the coolant to protect the cooling system against corrosion.

If there is no danger of freezing use only *Scania Anti-corrosive*.

The inhibitor in *Scania Anti-corrosive* is nitrite-free.

The correct level of anti-corrosive is **7-12% by volume**.

- Fill with *Scania Anti-corrosive* as indicated on the packaging.
- Topping up with 1.0% by volume of *Scania Anti-corrosive* should be done after every 400 operating hours.
- *Never top up with water only or anti-corrosive only. Lost fluid should always be replaced with pre-mixed coolant: water + 10% Scania Anti-corrosive by volume.*

Note: The coolant should be changed when the cooling system is cleaned: every 1,200 hours or at least every 3rd year.



WARNING

Corrosion inhibitor, if swallowed can be fatal. Avoid contact with the skin.

! Important

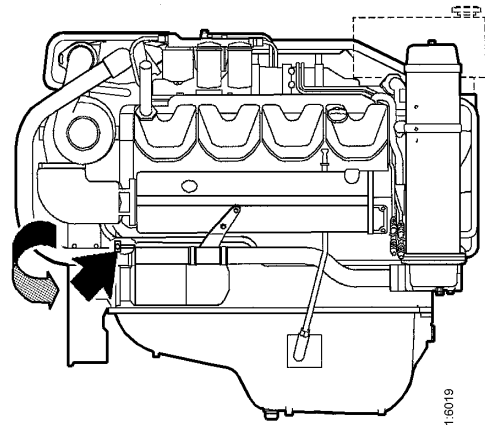
Mixing corrosion inhibitor with glycol or adding too much corrosion inhibitor may cause deposits and reduced cooling capacity.

! Important

If a coolant filter has been fitted it must not contain inhibitor.

Changing the coolant

1. Remove the filler cap from the expansion tank.
2. The coolant is drained at two points:
 - the "lowest point" of the engine block, see drawing
 - the "lowest point" of the cooling system.
3. Close the drain cocks.
4. Fill coolant through the expansion tank filler hole.
Mix coolant as described on page 32.



Mind the environment!

Always collect fluid in a suitable container to avoid spillage when changing coolant. Dispose of used coolant through an authorized waste disposal contractor.

9. Every 1200 hours: CLEANING THE COOLING SYSTEM

Note: If necessary, the cooling system should be cleaned more often.

External cleaning

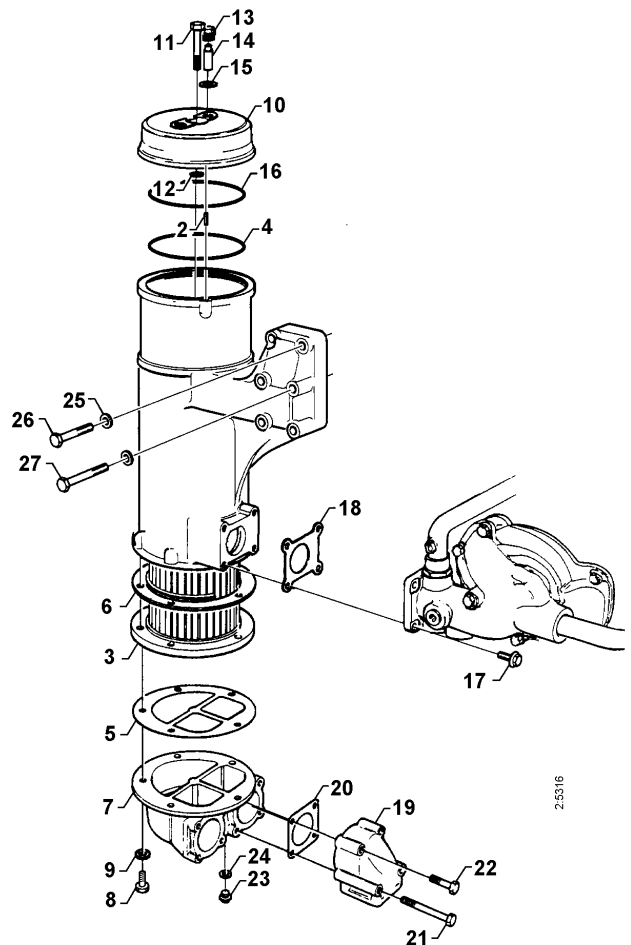
Heat exchanger

1. Drain the coolant from the engine, see “Changing coolant”.
2. Close the bottom valve or valves and drain the seawater circuit.
3. Disconnect the heat exchanger’s seawater pipe connections and the connections to the charge air coolers, oil cooler and block.
4. Remove the heat exchanger assembly and dismantle it as illustrated.
5. Clean the outside of the element. Use a paraffin-based engine cleaner.
6. Remove any deposit on the inside of the pipes using a round file.
7. Assemble the heat exchanger. Change damaged and hardened O-rings.
8. Make sure that the thermostats are in place and fit the heat exchanger back in place on the engine. Reconnect the pipes to the charge air coolers and oil cooler and also the return line from the block.
9. Fill the system with coolant as described in the specifications on page 32.

! Important
The cooling system must never be cleaned with caustic soda. There is a risk of damage to aluminium parts.

! Important
There are springs and retainers in the heat exchanger, between the housing and the element, which are not illustrated.

- | | |
|-----------------------|-----------------|
| 1. Housing | 15. Gasket |
| 2. Spiral pin | 16. O-ring |
| 3. Element | 17. Bolt |
| 4. O-ring | 18. Gasket |
| 5. Gasket | 19. Flange pipe |
| 6. Gasket | 20. Gasket |
| 7. Cover | 21. Bolt |
| 8. Bolt | 22. Bolt |
| 9. Washer | 23. Plug |
| 10. Cover | 24. Washer |
| 11. Bolt | 25. Washer |
| 12. O-ring | 26. Bolt |
| 13. Plug | 27. Bolt |
| 14. Sacrificial anode | |

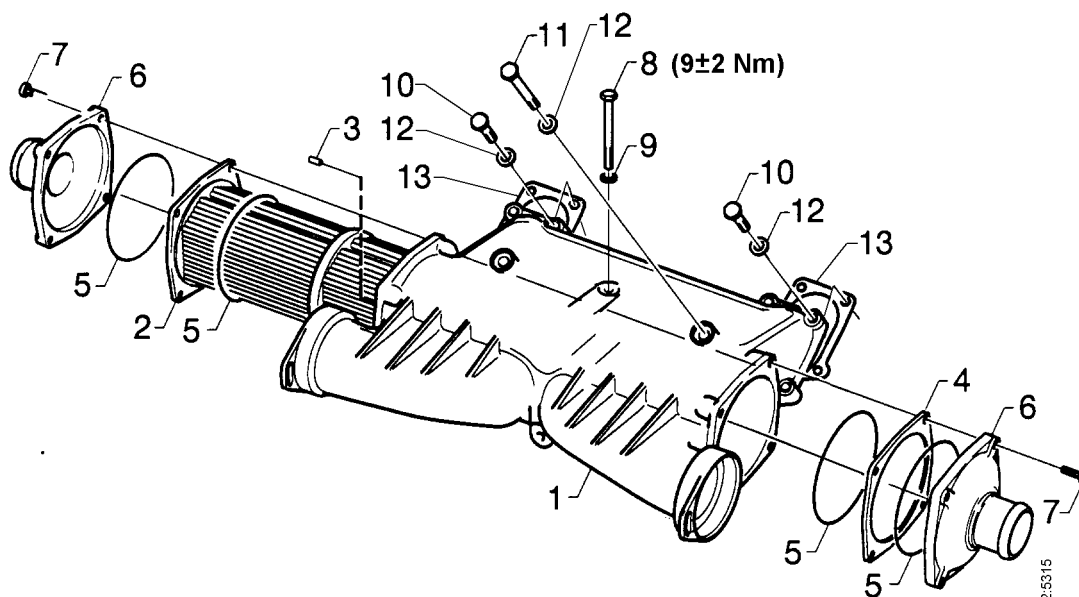


Seawater-cooled charge air cooler

1. Disconnect the connecting pipes for air and seawater and remove the charge air cooler assembly.
2. Dismantle the charge air cooler as illustrated.
3. Clean the outside of the element. Use a paraffin-based engine cleaner.
4. Remove any deposit on the inside of the pipes using a round file.
5. Assembly the charge air cooler. Change any damaged and hard O-rings.
6. Refit the charge air cooler assembly after the seawater-cooled charge air coolers have been cleaned and assembled.
Tighten bolt 8 to 9 ± 2 Nm.

Note: On assembly, silicone (816 064) should be applied to both sides of new gaskets 13.

7. Refit the pipe connections for air and seawater.



- | | |
|---------------|----------------|
| 1. Housing | 8. Bolt |
| 2. Element | 9. Washer |
| 3. Spiral pin | 10. Bolt |
| 4. Spacer | 11. Bolt |
| 5. O-ring | 12. Washer |
| 6. Cover | 13. Gasket (2) |
| 7. Bolt | |

Coolant-cooled charge air cooler

1. Drain the coolant from the engine, see “Changing the coolant”, and drain the seawater circuit if this has not been done when cleaning the heat exchanger.
2. Remove the catwalk, delivery pipes, fuel filter and water pipes to the turbo unit.
3. Remove the rear, transverse charge air cooler (seawater-cooled).
4. Undo the charge air cooler’s inlet and outlet pipe connections.
5. Dismantle the charge air cooler as illustrated.
Exercise care - do not damage the element’s water connections.
6. Clean the outside of the element. Use a paraffin-based engine cleaner.
7. Clean and degrease the sealing surfaces on the core and the air intake manifold upper and lower parts with a spirit based cleaner.
8. Apply sealant (silicone 816 064) in a uniform bead, approximately 2-3 mm, on both sealing surfaces of the element.
9. Fit new V-ring seals on the connections of the element.
10. Assemble the charge air cooler within 15 minutes of applying the sealant. Torque tighten the bolts to 50 Nm.
11. Reconnect the inlet and outlet pipe connections and refit the delivery pipe, fuel filter and other parts that have been removed.
12. Refit the transverse charge air cooler and its pipe connections for air and seawater.

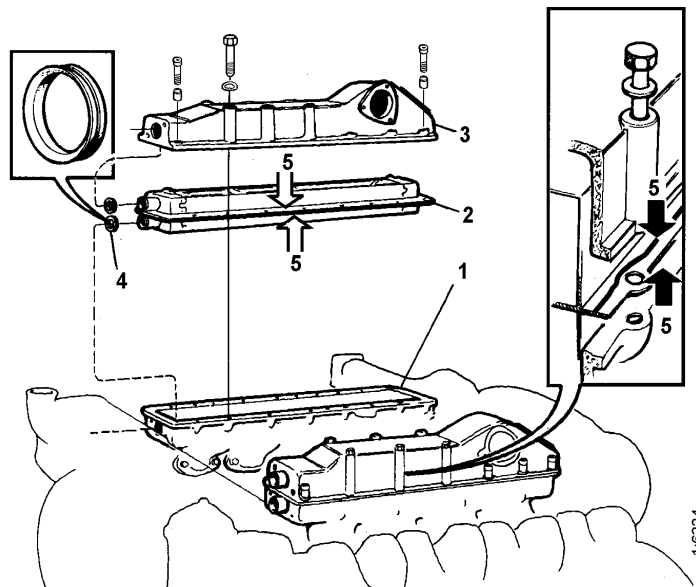
! Important
The cooling system must never be cleaned with caustic soda. There is a risk of damage to aluminium parts.

Note: On reassembly, apply silicone to the sealing surfaces against the seawater-cooled charge air cooler and its gaskets.

13. Fill up with coolant as per the specifications on page 32.

Important *Allow the sealant to cure for minimum 24 hours before the engine is used.*

1. Intake manifold, lower part
2. Radiator element
3. Intake manifold, upper part
4. V-ring seal
5. Sealant 816 064



Internal cleaning

Removing oils and greases

- If possible, run the engine until it is warm and then drain the cooling system.
- Remove the thermostats. This will necessitate removal of the heat exchanger assembly. It is therefore advisable to do this in connection with cleaning the heat exchanger.
- Fill the system with clean, hot water mixed with liquid dishwasher detergent designed for household machines. Mix 1% (0.1/10 l).
- Warm up the engine for about 20 or 30 minutes. Do not forget the cab heating system, if any.
- Drain the cooling system.
- Fill the system again using clean, hot water and run the engine for about 20-30 minutes.
- Drain the water from the system.
- Refit the thermostats.
- Fill the system with coolant as described in the specifications on page 32.



WARNING

**Handling cleaning agents for the cooling system:
Read the warning label on the container.**

Removing deposits

- If possible, run the engine until it is warm and then drain the cooling system.
- Remove the thermostats. This will necessitate removal of the heat exchanger assembly. It is therefore advisable to do this in connection with cleaning the heat exchanger.
- Fill the system with clean, hot water mixed with one of the commercially available radiator cleaners based on sulphamic acid and containing dispersing agents. Follow the manufacturer's instructions for mix ratios and cleaning times.
- Run the engine for the specified time and then drain the cooling system.
- Fill the system again with hot water and run the engine for about 20 or 30 minutes.
- Drain the water from the system.
- Refit the thermostats.
- Fill the system with coolant as described in the specifications on page 32.



Mind the environment!

**Always collect fluid in a suitable container to avoid spillage when draining coolant.
Dispose of used coolant through an authorized waste disposal contractor.**

Preventive replacement of coolant pump gear

Note: To be carried out in connection with cleaning of the cooling system.

- Remove the coolant pump.
- Remove the drive gear.
- Fit a new gear and tighten the nut to 200 Nm.

Note: Do not apply the tightening torque to the gear itself.

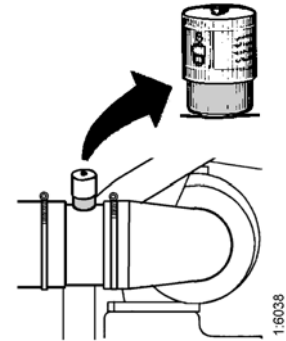
- Refit the coolant pump, using new gaskets for the timing gear cover.

AIR CLEANER

10. Daily:

TEST READING LOW PRESSURE INDICATOR

If the indicator's red plunger is fully visible, change or clean the air cleaner filter insert, point 11.



11. Every 1,200 hours:

CLEANING OR CHANGING THE FILTER INSERT

Note: Earlier if low pressure indicator shows red.

Dismantling

1. Remove air cleaner's side cover.
2. Change or clean the insert.

Note: Cleaning the insert always entails a risk of damage. The insert may be cleaned no more than four times. After cleaning, it has a lower dust capacity than a new insert.

3. Mark the filter when it has been cleaned.

Cleaning insert

- Carefully blow the filter insert clean using dry compressed air from the inside.

Note: This insert must not be washed using water.

! Important

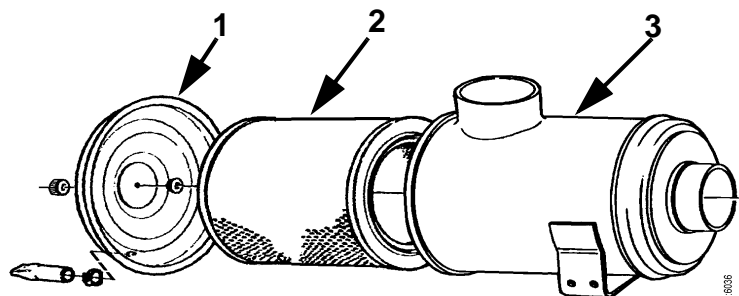
Only use Scania genuine air filter. Change the filter element if it is damaged.

Danger of engine damage if the filter element is damaged.

! WARNING

Never start the engine unless the air filter is installed.

Danger of personal injury or engine damage.



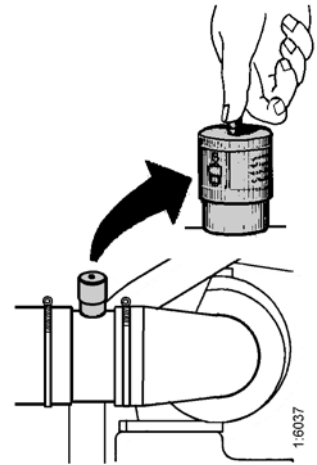
1. Cover
2. Filter insert
3. Filter housing

Checking

- Insert a flashlight into the insert and check from the outside that there are no holes or cracks in the filter paper.
- Change the filter insert if there is any damage at all. Danger of engine damage.

Assembly

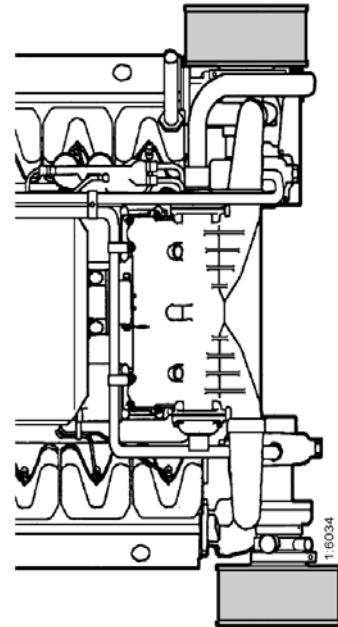
1. Assemble the air cleaner in reverse order.
2. Reset the red plunger in the low pressure indicator by pressing in the button.



Filter with non-replaceable insert (unit cleaner)

Cleaning

- The filter must be cleaned no more than 3 times. Make a mark on it each time it is cleaned.
 - Use a washing solution consisting of water mixed with about 1% mild detergent.
1. Pour the washing solution into the filter outlet while turning the filter so that the solution runs out of it opposite to the direction of air flow.
 2. Leave the filter in the washing solution for 5 minutes and then lift it to drain off the solution.
 3. Rinse the filter with about 30 litres of clean water at 30 - 40 °C. Pour the rinse water into the filter in the same way as the washing solution.
 4. Lift the filter and allow the rinse water to drain.
 5. Repeat this procedure until the rinse water runs clear.
 6. Leave the filter to dry in a warm place for a day or so.



Note: The filter must not be blown dry using compressed air.

FUEL SYSTEM

12. Daily: CHECKING THE FUEL LEVEL

- Top up fuel if necessary.
- If the tank is run dry, bleed the fuel system, see point 13.

13. Every 1200 hours: CHANGING THE FUEL FILTER

Fuel tanks

- Drain any water from the fuel tanks.

Filter

The filter consists of two filter units connected in parallel.

- Wash the outside of the filters and unscrew them. Dispose of the filters according to environmental regulations.
- Tighten the new filters *by hand*.

Never use tools. The filters may be damaged, inhibiting circulation.

- Bleed the fuel system as described below.
- Start the engine and check for leaks.

Bleeding the fuel system

- Open bleed screw **1** on the main filter.
- Pump hand pump **2** until air-free fuel flows out at the main bleed screw.
- Close the bleed screw. Pump a few times using the hand pump.

If the engine is difficult to start after bleeding

- Slacken injection pump overflow valve **3** half a turn and make a fresh attempt to start.

If the engine still won't start

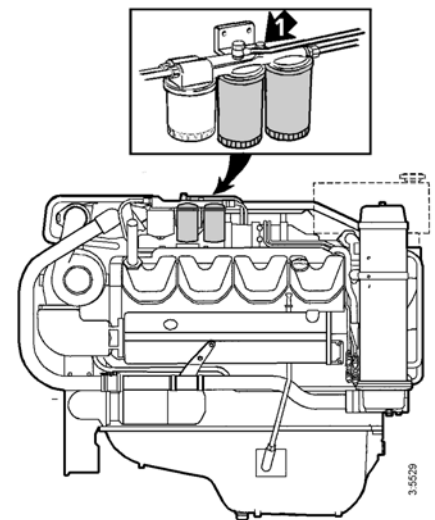
- Pump the hand pump until bubble-free fuel flows from the overflow valve.

Tighten the overflow valve when the engine has started.

! Important

Be extremely careful with cleanliness when working on the fuel system.

Malfunctions can easily arise and the injection equipment can be damaged.

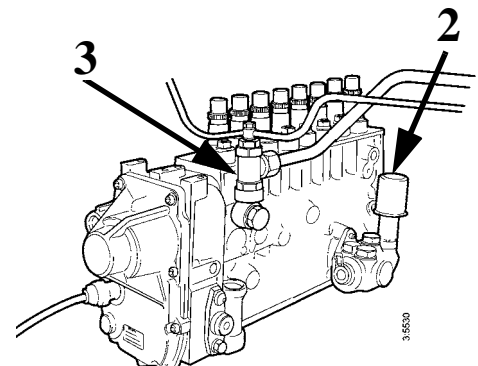


! Important

Only use Scania genuine fuel filter.

Mind the environment!

Always collect fuel in a suitable container to avoid spillage when bleeding system or renewing components.



14. Every 1,200 hours: CHECKING INJECTORS

Injectors should be inspected by trained personnel with access to the required equipment, at least once every year or every 2,400 hours.

Removal

1. Clean around the injectors and connections including clamps and brackets.
2. Undo the leak-off pipes and bunch of delivery pipes. Be careful to **avoid bending** any of the delivery pipes.
3. Unscrew the injector.
4. Place protective plugs on the injector and delivery pipe.
5. Lift the seal from the bottom of the injector seat if it does not come out together with the injector.
6. Place a seal plug in the injector seat in the cylinder head.
7. Clean the injectors and check/adjust in an injector tester.

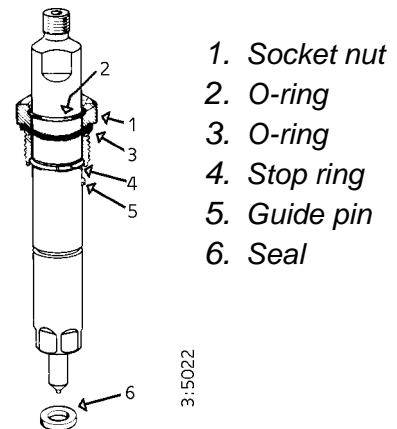
Correct opening pressure, see Technical data, page 52.

Fitting

1. Check that there is no old seal in place and fit a new seal in the bottom of the injector seat.
2. Fit a new O-ring in the socket nut and a new seal under it.
3. Fit the injector.
4. Tighten the socket nut to 70 Nm (7.0 kgfm).
5. Fit the delivery pipe and tighten the cap nuts to 20 Nm (2.0 kgfm). Fit clamps and brackets.

Take care to fit the delivery pipe without tension and make sure that the cone on the delivery pipe is correctly positioned in the connection.

6. Fit the leak-off fuel line. Tighten the bolts to 11 Nm (1.1 kgfm).



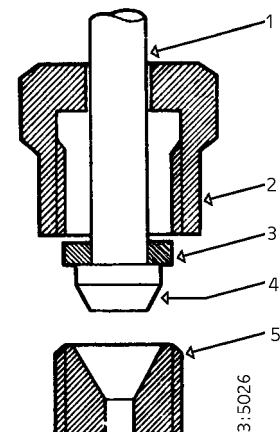
! Important

**The delivery pipes must not be bent.
All clamps must be refitted.**



WARNING

**Always wear gloves and eye protection when testing injectors.
Fuel escaping under high pressure can penetrate body tissue and cause serious injury.**



1. Delivery pipes
2. Cap nut
3. Washer
4. Cone
5. Connection on injector or injection pump

Delivery pipe connection

ELECTRICAL SYSTEM

15. Every 200 hours:

CHECKING THE ELECTROLYTE LEVEL IN BATTERIES

1. Unscrew the plugs and check the electrolyte level in all cells.
2. Top up with distilled water until the level is 10-15 mm above the plates.



WARNING

Do not let open flame or sparks come near the batteries.
When batteries are charged, they emit highly flammable fumes that can explode.

16. Every 200 hours:

CHECKING THE CHARGE STATE OF THE BATTERIES

- Check the specific gravity using a hydrometer (battery electrolyte tester).
In a fully charged battery it should be:
1.280 at +20 °C
1.294 at 0°
1.308 at -20 °C
 - If the specific gravity is below 1.20, the battery must be charged. A discharged battery freezes at -5 °C.
 - Trickle charging is recommended during the winter if the engine is not used.
- Avoid boost charging. This will damage the battery in the long term.*



WARNING

Wear gloves and eye protection when charging and handling batteries.
Batteries contain a highly corrosive acid.

17. Every 200 hours:

CLEANING BATTERIES

1. Clean batteries, cables and cable terminals.
2. Check that all cable terminals are well tightened.
3. Grease posts and cable terminals using petroleum jelly.



WARNING

Do not connect the cables to the wrong terminals.
This could cause serious damage to the electrical system.
If the terminals are shortcircuited, sparks will be generated.

CHANGING BATTERY

Removal

1. Detach the negative lead (-) from the battery (cable to engine casing).
2. Detach the positive lead (+) from the battery (cable to starter motor).

Fitting

1. Connect the positive lead (+) to the battery (cable to starter motor).
2. Connect the negative lead (-) to the battery (cable to engine casing).



WARNING

Do not connect the cables to the wrong terminals.

This could cause serious damage to the electrical system.

If the terminals are short-circuited, sparks will be generated.



Mind the environment!

Dispose of used batteries through an authorized waste disposal contractor.

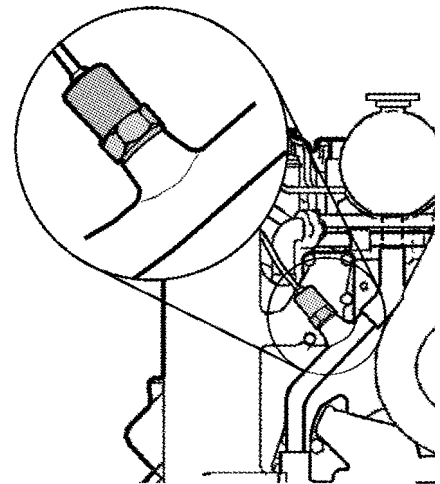
18. Every 400 hours:

CHECKING THE COOLANT LEVEL MONITOR

(optional equipment)

Note: The level monitor should be checked when the engine is cold.

1. Undo the clamps on the level monitor's lead to the wiring harness on the engine and unplug the connector.
2. Place a receptacle under the coolant pump and unscrew the monitor. Immediately fit a plug with an M18x1.5 thread in the hole for the monitor. *Avoid getting the coolant on your skin.*
3. Plug in the monitor's connector and set the control switch to "ON".
4. Check that the indicator lamp remains on and that the buzzer sounds.
5. Submerge the monitor in liquid in a metal receptacle (steel). It is important to ensure that the body of the monitor is in contact with the metal.
6. The indicator lamp should go out after about 2 seconds.
7. Remove the monitor from the liquid. In about 7 seconds the indicator lamp should come on and the buzzer start to sound.
8. Unplug the monitor's connector and screw the monitor back in place.
9. Clamp the monitor's lead as before and plug in the connector.
10. Fill the system with coolant as described in the specifications on page 32.



MISCELLANEOUS

19. Every 200 hours:

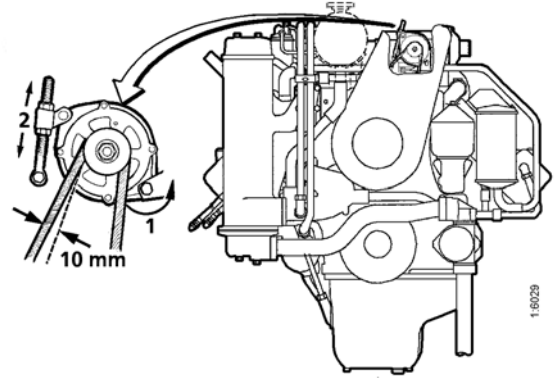
CHECK/TENSION V-BELTS

If correctly tensioned, a pressure of 35-50 N on a drive belt (depending on the free length of the belt) should deflect it about 10 mm.

Change worn or damaged belts.

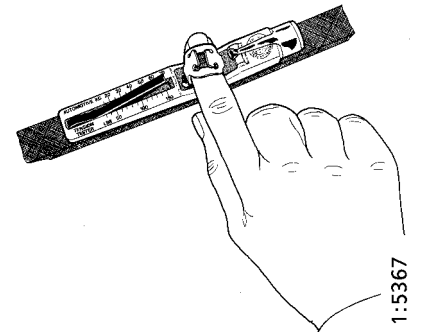
1. Detach the securing screws.
2. Set the correct tension using the adjusting screw.

Do not overtighten the belts.



Measurement using a Kriket belt tension gauge (Part. No. 587 495)

1. Zero the gauge by pressing the measuring arm.
2. Place the gauge on the V-belt at an equal distance from two pulleys.
3. Press until the gauge clicks.
4. Read the gauge.
 - The recommended tension of genuine Scania belts when tested is **300 N**.



When changing belts, slightly higher (10-15%) tension should be used.

20. Daily:

LOOK FOR LEAKS, REMEDY AS NECESSARY

- Start the engine.
- Look for leakage of oil, coolant, fuel, air and exhaust.
- Tighten or change leaking connections. Check the overflow holes (1) which show whether the O-rings between the cylinder liner and crankcase are leaking, see drawing.
 - a) If coolant is leaking out, the two upper O-rings are leaking.
 - b) If oil is leaking out, the lower O-ring is leaking.
- Check that the drain hole (2) on the coolant pump is not blocked, see drawing. If there is leakage, change the pump seal.
- Check that the drain for the "V" behind the injection pump is open all the way through the block and drain pipe so that no fluid can collect in the "V". See drawing.

A small amount of leakage from the overflow holes when running-in the engine is normal. (Seals and O-rings are fitted lubricated with soap or oil).

This leakage normally stops after a time.

If there is a large amount of leakage - contact your nearest Scania workshop.

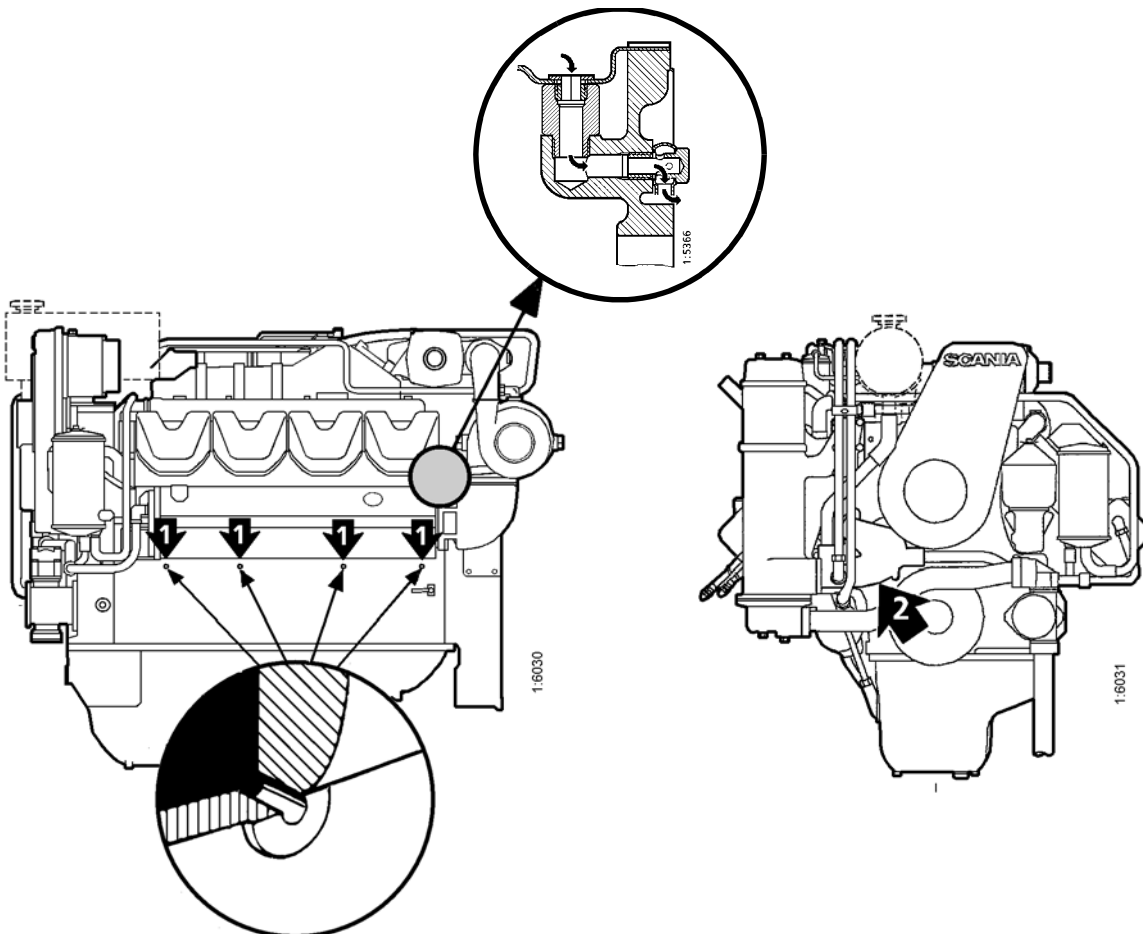


Mind the environment!

Ensure that any leakage does not pollute the environment.

! Important

In case of major leakage, contact the nearest Scania workshop.



21. Every 1,200 hours: CHECKING/ADJUSTING VALVE CLEARANCE

Checking/adjusting valve clearance should be done after the first 400 hours of operation.

Valves should be adjusted when the engine is cold, at least 30 minutes after running.

Rocker cover gaskets should be changed as necessary. Tightening torque: 25 Nm.

Alternative 1

- Turn the crankshaft in its direction of rotation until the piston in cylinder No. 1 is 30° after TDC on the combustion stroke. There is a mark, ⊥, at this position.

- Adjust the following valves:

Right side	Cyl 1	Intake and exhaust
	2	Ex
	4	Ex
Left side	Cyl 5	In and ex
	7	In
	8	In

- Turn the crankshaft one revolution in its direction of rotation to the ⊥ mark. The piston in cylinder No. 1 will then be 30° after TDC on the induction stroke.

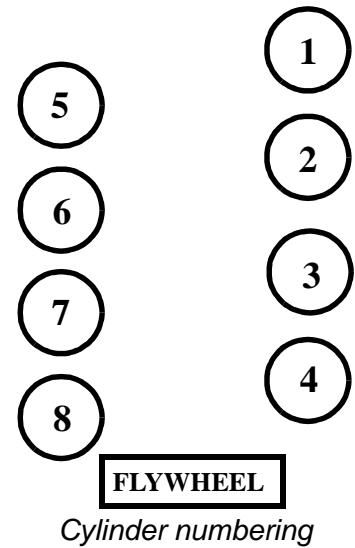
- Adjust the following valves:

Right side	Cyl 2	In
	3	In and ex
	4	In
Left side	Cyl 6	In and ex
	7	Ex
	8	Ex

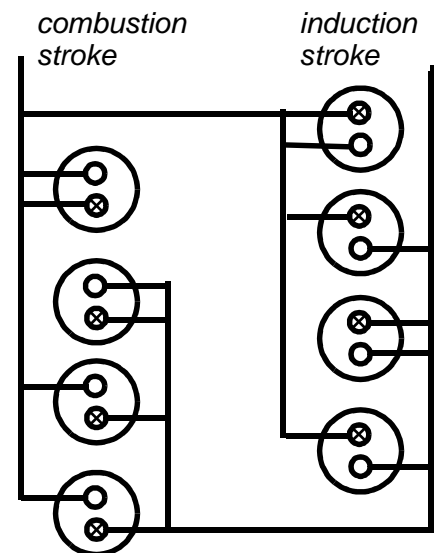
! WARNING

Immobilise the starting device when working on the engine.

If the engine starts out of control, there is a SERIOUS RISK OF INJURY.



No. 1 cylinder piston 30° after TDC in



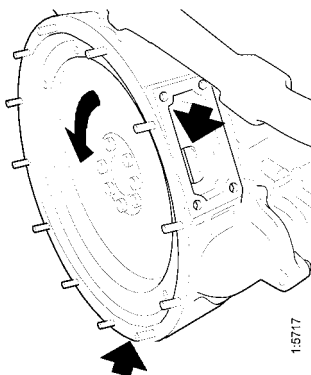
FLYWHEEL

- Intake valve
- ⊗ Exhaust valve

Important.

On *silumin housings*, reading is possible only from underneath.

On *ductile cast iron housings*, reading is possible from underneath or from the side (60°), depending on accessibility.



Covers for reading on flywheel casing

Alternative 2

- Set the No. 1 cylinder to TDC by turning the engine in its direction of rotation until both valves are closed.
- Adjust both the valves for the No. 1 cylinder. Correct valve clearance is indicated on the instruction plate on one of the rocker covers.
- Repeat this procedure with the remaining cylinders in the order 5 - 4 - 2 - 6 - 3 - 7 - 8 (firing order) by turning the engine 1/4 revolution in its direction of rotation between each adjustment.

22. Every 1,200 hours:

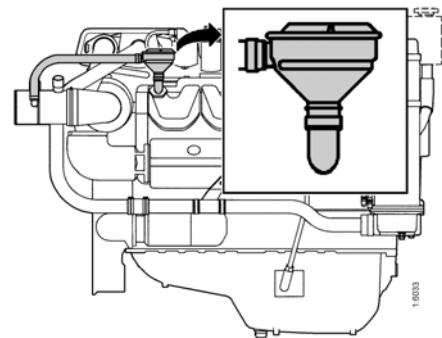
CHANGING (or CLEANING) VALVES FOR CLOSED CRANKCASE VENTILATION

Alternative 1:

Change the valves at the specified interval.

Alternative 2:

- Remove the valves at the specified interval.
- Clean the valves by placing them in a bath of diesel oil overnight. Then rinse them several times in diesel oil and leave them to drain off.
- Refit the valves.
- The valves may be reused (cleaned) *no more than twice* after the first 1,200 hours of use. Be sure to mark the valves in connection with cleaning them.



LONG-TERM STORAGE

If the engine is not to be used for a lengthy period of time, special measures should be taken to protect the cooling system, fuel system and combustion chamber from corrosion and the exterior from rusting.


The engine can normally stand idle for up to six months. If it remains unused for longer than this the following measures, which provide protection for about four years, should be adopted. An alternative to preparing the engine for long-term storage is to start the engine and warm it up every 6 months.

Preparing the engine for long-term storage means:

- Thoroughly cleaning the engine
- To run the engine for a period of time with preservative fuel, preservative oil and preservative coolant.
- Otherwise preparing the engine for storage (filter changes, lubrication, etc.).

Preservative coolant

If the engine is to be stored with a full cooling system, use coolant containing 50% glycol by volume. Glycol *without* nitrite-based inhibitor must be used. E.g. **BASF G48** or **BASF D542**.



WARNING

Ethylene glycol, if swallowed can be fatal.

Avoid contact with the skin.

Preservative fuel

- Use diesel fuel mixed with Lubrizol 560A or equal.
- Mix 1 cm³ (ml) of Lubrizol 560A with 10 dm³ (l) of fuel.



HANDLING LUBRIZOL 560A

Hazardous!

Contains aromatic hydrocarbons

Use spot extractors where there is a danger of vapour build-up.

Wear protective gloves and goggles when handling Lubrizol. Do not use contaminated clothing.

In case of splashes in the eye: Rinse with moderate water spray (for min. 15 minutes). Seek medical attention.

In case of skin contact: Wash affected areas with soap and water.

If you inhale it: Fresh air, rest and warmth

Flammable: Fire class 2A. Flash point + 27°.

In case of fire: Extinguish using carbonic acid, powder or foam

Storage: In properly sealed container in a dry, cool place. **Keep out of reach of children.**

Preservative oil

Suitable preservative oil can be supplied by most oil companies.

E.g. Dinitrol 40 or the equivalent.

Preparations for storage

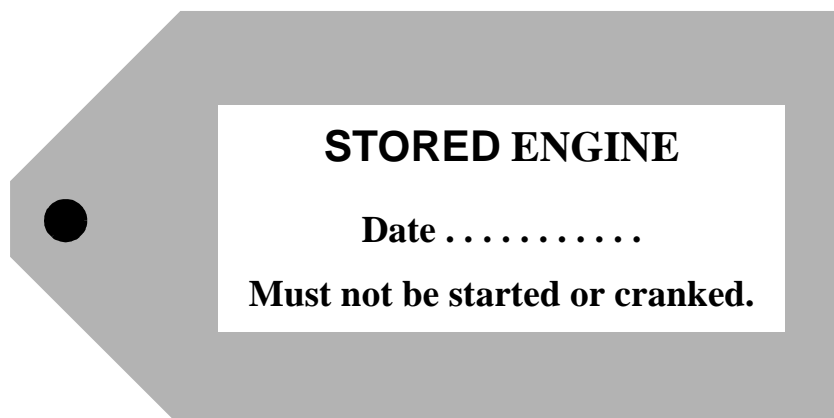
- Drain and flush the cooling system. Fill with preservative coolant.
- Run the engine until warm with ordinary fuel. Stop the engine and drain the oil.
- Change fuel filter and turbo filter.
- Fill the engine with preservative oil to the minimum level on the dipstick.
- Mix the preservative fuel in a can. Detach the fuel pipe at the feed pump suction line and connect a hose from the can.
- Detach the fuel pipe at the overflow valve and connect a return hose to the can.
- Start the engine and run it at about 1000 rpm for 20 - 25 minutes.
- Stop the engine, remove the hoses and connect the normal fuel lines.
- Oil the valve mechanism with plenty of preservative oil.
- Remove the injectors and spray preservative oil into each cylinder **max. 30 cm³(ml)**.
Crank the engine several revolutions using the starter motor. Spray a **small** amount into each cylinder.
The engine must not then be cranked. Refit the injectors.
- Drain the preservative oil from the engine. New engine oil can be filled directly or when taken out of preservative.
- Drain the coolant if the engine is not to be stored with a full cooling system. Plug and tape over all coolant connections (if the cooling system is not completely assembled).
- Air cleaner: Clean and change the filter insert.
- Cover air intakes and exhaust pipes.
- Alternator and starter motor:
 - Spray with water-repellent anti-corrosive oil, CRC 226, LPS1 or the equivalent.
- Spray the outside of shiny engine parts, first using penetrating preservative oil such as Dinitrol 25B and then using Dinitrol 112 or the equivalent.



Mind the environment!

Always use suitable containers to avoid spillage when draining oil and coolant. Dispose of used oil and coolant through an authorized waste disposal contractor.

- *Attach a clear notice to the engine with the date of preservation and stating that the engine must not be started or cranked.*



Batteries

Remove the batteries for maintenance charging in the charging station. (Does not apply to batteries which, according to the manufacturer, are maintenance-free). The same also applies to short periods of disuse, even if the engine is not stored as above.

Taking out of storage

(action when the engine is taken into service)

- Remove plugs and tape from coolant connections, air intakes and exhaust pipes.
- Fill the cooling system with coolant, see page 18.
- Check the oil level in the engine and top up with new oil.
- Crank the engine several revolutions with the injectors removed, oiling the valve mechanism, pushrods and tappets with plenty of oil.

Important: *The engine must be cranked with the injectors removed so that excess preservative oil can be forced out of the cylinders.*

- Fit the injectors.
- Drain the fuel system's main filter of preservative fuel.
- Bleed the fuel system.
- Wash off externally applied preservative oil using white spirit.

Winter storage

The fuel tank or tanks should be filled up during winter storage to reduce the risk of condensate forming.

FUEL SYSTEM		DI14
Pump setting BTDC		See plate on rocker cover
Injectors, opening pressure	bar (kgf/cm ²)	300
Low idle	rpm	700
Maximum full load speed		See engine card
Fuel		Diesel fuel oil ¹⁾
Tightening torques:		
Socket nut for injectors	Nm	70
Cap nut for delivery pipe	Nm	20
Oil leakage connection	Nm	11
¹⁾ see page 54		
COOLING SYSTEM		
Number of thermostats		2
Thermostat, opening temperature	°C	79±2
Thermostat in charge air circuit, opening temperature	°C	50±2
Coolant temperature: system with overpressure	°C	70 - about 100
Volume:	dm ³ (litres)	about 95
ELECTRICAL SYSTEM		
System voltage	V	24
Alternator, current	A	65 or 120 or 2x65
Starter motor power	kW (hp)	6.7 (9.1)
Monitors, settings:		
oil pressure monitor	bar (kgf/cm ²)	2-pole:0.7 ±0.15 Stamped on monitor hexagon
temperature monitor	°C	

FUEL

Diesel fuel

The composition of the diesel fuel is vitally important to the operation and life of the engine and the fuel injection pump. The engine power output and the exhaust emissions are also dependent on the fuel quality.

The requirements and the test standards for the most important properties are described in the workshop manual in sections that can be ordered from your Scania dealer or directly from Scania. The address of Scania is printed on the cover.

The diesel fuel shall comply with the following standard:
EN 590 (European standard).

The table below shows the requirements for some of the most important properties:

! Important
Additives must not be used.

Property	Requirement
Viscosity at 40°C	2.0 - 4.5 mm ² /s (cSt)
Density at 15°C	0.82 - 0.86 kg/dm ³
Sulphur (concentration by mass)	max. 0.3%
Ignitability (CET rating)	min. 49
Flashpoint	56°C

Environmentally favourable fuels (low sulphur fuels)

There are three different grades of so called environmentally favorable fuels (SS15 54 35). Grade 1 is sulphur-free and grade 2 is low in sulphur. Compared with class 3 (normal fuel), these fuels are less dense and this reduces engine power output. Only class 1 fuel should be used with a catalytic converter.

Short term use of fuel with a higher sulphur content than 0.05% by weight will not cause permanent damage to the catalytic converter.

The catalytic converter may, however, require fuel with low sulphur content for some time after this to regain its normal efficiency.

ALPHABETICAL INDEX

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